

**Habitats Used, Abundance and Distribution  
of the Mexican Spotted Owl  
*Strix occidentalis lucida*  
on  
National Forest System Lands**

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## Introduction

The Southwestern Region of the U.S. Forest Service has been concerned about the status of the Mexican spotted owl (*Strix occidentalis lucida*) since the early 1980's when several Draft Forest Plans proposed increases in the amount of timber to be harvested from steep slopes greater than 40 percent. These steep slopes contained most of the spotted owl habitat known at that time. Historically there was little timber harvested from these steeper areas because of the need to use cable equipment instead of tractors to skid logs out of a harvest unit, thus there was little concern expressed about the continued viability of this species. The Mexican spotted owl (MSO) was added to the Regional Forester's Sensitive Species List in 1983 as a result of increased concern for the owl's viability.

At the time the Mexican subspecies was classed as sensitive by the Region, it was also classified by the U.S. Fish and Wildlife Service under the Endangered Species Act as a Category II species, one for which there is not sufficient information to determine if listing is warranted. Because of the paucity of information available on the Mexican spotted owl, the Region began cooperative efforts with both Arizona and New Mexico Departments of Game and Fish to expand the information available on habitat use, home range, and other aspects of the owl's biology. These joint efforts resulted in completion of the only telemetry study on the Mexican subspecies, status reviews for both states, and other studies on spotted owl biology and habitat use.

In January 1988, the Regional Forester, Southwestern Region, formed a Task Force comprised of Forest Service and other Federal and State agency biologists and managers, representatives of commodity and non-commodity industries and organizations, and spotted owl researchers. Their task was to provide recommendations to the Regional Forester on MSO management and studies.

In June 1989, the Regional Forester adopted Interim Directive No. 1 (ID No. 1), which was based on recommendations made by the Task Force. It established methods to search for, establish, and manage MSO Management Territories whenever an MSO was found. A Management Territory is an administrative representation of what wildlife biologists believe is the home range of a spotted owl once an MSO has been located during an MSO inventory.

ID No. 2 was issued in July 1990. The revisions to ID No. 2 were based on comments made to ID No. 1 during the 60-day comment period provided for in our Federal Register notification of adoption of ID No. 1. In addition, the Task Force reviewed a number of alternative management strategies and provided the Regional Forester with several scenarios.

In December 1989, the U.S. Fish and Wildlife Service (FWS) received a petition to list the Mexican spotted owl. FWS requested all available information be provided to them by October 1990. The information included in this report was compiled and analyzed to provide the FWS status review team with all the information available to the Forest Service through the 1990 field season that was not already in a completion report for the various studies initiated by the Region. Maps of each Forest's owl habitat were also provided.



## Methods

The amount of Mexican spotted owl (MSO) habitat was estimated on each Forest in Arizona and New Mexico by habitat type and land status. The amount surveyed was identified and the number of Management Territories established was noted, both by habitat type and land status.

Suitable habitat was defined by using the stand characteristics reported by Ganey (1988). These characteristics include multistoried stands with a canopy that is generally greater than 70 percent closed. Steep slopes and canyons were other important characteristics used to define suitable habitat. Mixed conifer was thought to be the primary type used, but other types meeting the criteria were also included. Most of the habitat acreages were estimated from stand database information, air photo interpretation and some ground truthing. Some of the habitat was identified using LANDSAT imagery based on a predictive model developed by Ganey (1989).

Capable MSO habitat was defined as those areas not meeting suitable conditions at the present time that could become suitable at some point in the future. No limit was placed on the length of time it may take to become suitable for a stand to be considered capable.

Land status was divided into two categories; one with two, and one with three sub-categories. These were: lands available for timber harvest, and lands not available for timber harvest. The available category was divided into: suitable for harvest according to the Forest Plan, and tentatively suitable (lands not necessary to meet projected demand for wood products). The not available category was divided into: lands unsuitable for timber harvest, lands administratively withdrawn (suitable for timber harvest but made not available in the Forest Plan to meet other resource needs), and reserved lands (withdrawn by law, etc).

One Forest did not update the information available on the amount of suitable and capable by habitat type and land status; existing information was used. Several Forests lumped mixed conifer, ponderosa pine, and pine/oak into one category. Here, I proportioned this total to each habitat type based on the Regional average without their data. This proportionment was also done for the number of Management Territories.

For each Management Territory, the amount and type of various Territory and core area characteristics were delineated, including the amount of suitable, capable, and unsuitable MSO habitat, the amount of old growth present, the core and Territory size, the size of the largest block of contiguous suitable habitat, and the amount of past and newly proposed activities. Past activities were considered those being sold or authorized prior to ID No. 1 issued June 1989, and new activities were ones sold or authorized since spotted owl Management Direction was adopted. Some Forests did not provide an analysis of each Territory and some of the ones submitted did not contain sufficient information to analyze.

Each Forest provided information between 1980 and 1990 on the annual sale quantity (ASQ), volume of timber offered and sold, acres necessary to provide the volume sold, acres of MSO habitat entered, acres of MSO habitat made capable, the acreage of each of the types of timber management scenario used, the acreage of MSO habitat entered by each management scenario, and the amount made capable by each scenario.

## MSO Habitat

Over 4.4 million acres of MSO habitat was mapped on the 11 National Forests in Arizona and New Mexico (Fig. 1). Suitable habitat made up over 76 percent of the amount mapped. Mixed conifer and ponderosa pine (*Pinus ponderosa*) habitat types made up over 89 percent of the amount mapped. Pine/oak types made up nearly 8 percent while other types of habitat providing suitable or capable characteristics made up less than 3 percent.

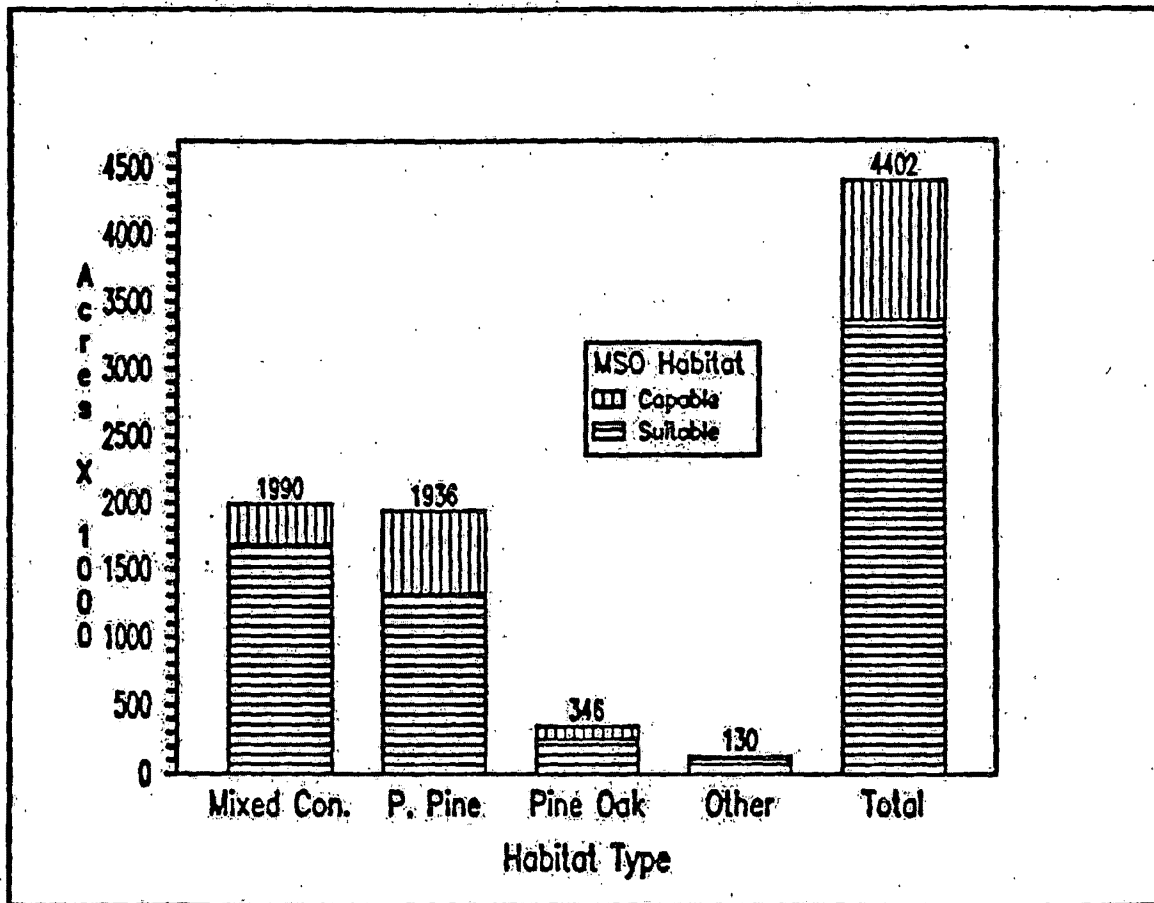


Figure 1. Estimated amount of suitable and capable Mexican spotted owl habitat by type on National Forest System Lands in Arizona and New Mexico.

## Types of Suitable Habitat

Over 3.36 million acres of suitable MSO habitat was mapped on National Forest System lands in the Southwestern Region (Fig. 2). Mixed-conifer habitat types made up just over half of the suitable acres identified. These mixed-conifer stands are generally dominated by Douglas-fir (*Pseudotsuga menziesii*), white fir, (*Abies concolor*) or a combination of the two. They often contain a component of ponderosa pine, southwestern white pine (*P. strobiformis*), and/or limber pine (*P. flexilis*). Gambel oak (*Quercus gambellii*) is often present in the understory. Aspen (*Populus tremuloides*), bigtooth maple (*Acer grandidentatum*), and/or boxelder (*A. negundo*) are also found in the understory, but to a lesser extent. Locally, especially in southern Arizona and southwest New Mexico, Apache (*P. engelmannii*) and Chihuahuah (*P. leiophylla*) pine are found in the stand. The Apache-Sitgreaves (68%), Carson (81%), and Lincoln (76%) Forests contain the highest proportion of mixed-conifer habitat while the Coconino (13%) has the lowest percentage of mixed-conifer habitat (Fig. 3).

Ponderosa pine types make up the next largest block of MSO habitat with over 40 percent of the acres mapped being of this type. These pine types are dominated by ponderosa pine. Other conifers are often present in the stand but they are only a minor component when present. Hardwoods are generally lacking or make up only a small portion of the understory. Ponderosa pine types make up the largest proportion of suitable habitat on the Coconino (52%), Gila (56%), and Santa Fe (60%) while the Cibola (20%), Carson (20%), Coronado (7%), and Kaibab (3%) have the least (Fig. 3).

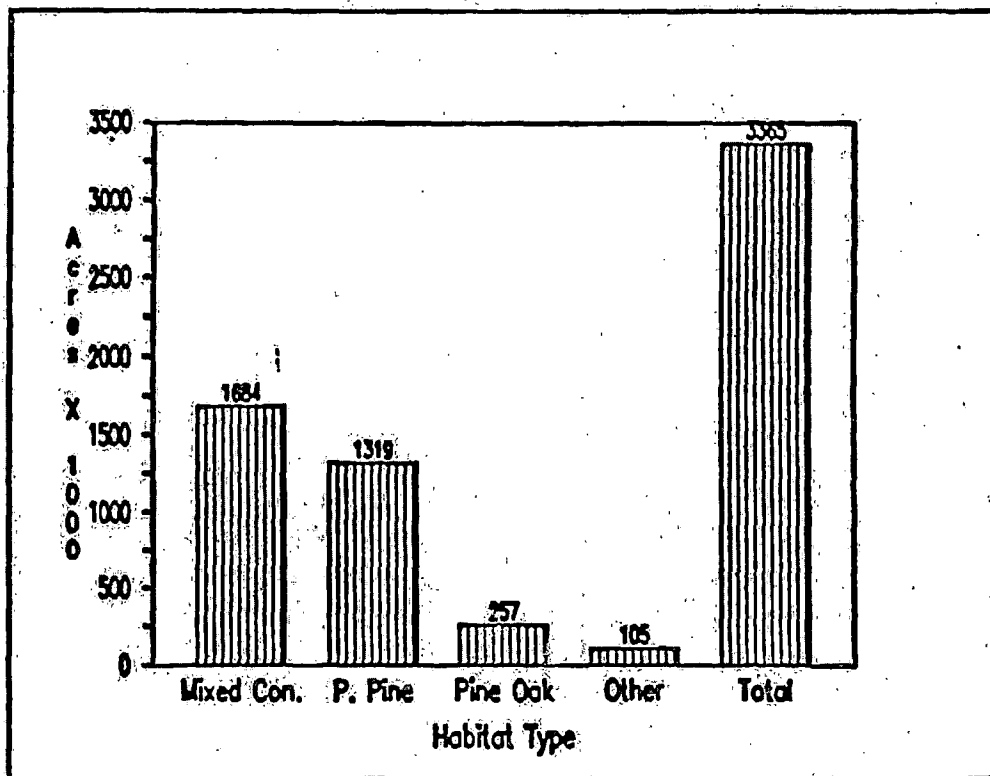


Figure 2. Types and amount of suitable Mexican spotted owl habitat on National Forest System Lands in Arizona and New Mexico.

Pine/oak stands comprise nearly 8 percent of the suitable habitat and are generally dominated by ponderosa pine with a significant understory of Gambel oak. Gambel oak may also make up a prominent portion of the mid-story stand structure. Other hardwoods may comprise a portion of the understory. Apache and/or Chihuahuah pine often replace ponderosa pine in southern Arizona, especially at lower elevations. The Cibola (28%), Coconino (29%), and Coronado (20%) have the largest proportion of pine/oak as suitable habitat of all the Forests. Four reported no pine/oak.

About 3 percent of the suitable habitat identified in the Region is comprised of other habitat types. These other types include stands dominated by aspen, Arizona cypress (*Cupressus arizonica*), subalpine fir (*Abies lasiocarpa*), and/or Engelmann spruce (*Picea engelmannii*), cottonwood (*Populus spp.*), and oak (*Quercus spp.*) riparian, and evergreen oak (*Quercus spp.*), pinyon pine (*Pinus spp.*), and juniper (*Juniperus spp.*) woodlands. These types, except spruce/fir, are usually found at lower elevations and often in canyon bottoms. Spruce/fir stands are generally found at the higher elevations or in some cold air drainages at midelevations. The Cibola (8%), Coconino (6%), Coronado (30%), and Lincoln (5%) were the only Forests with a wide variety of habitats present.

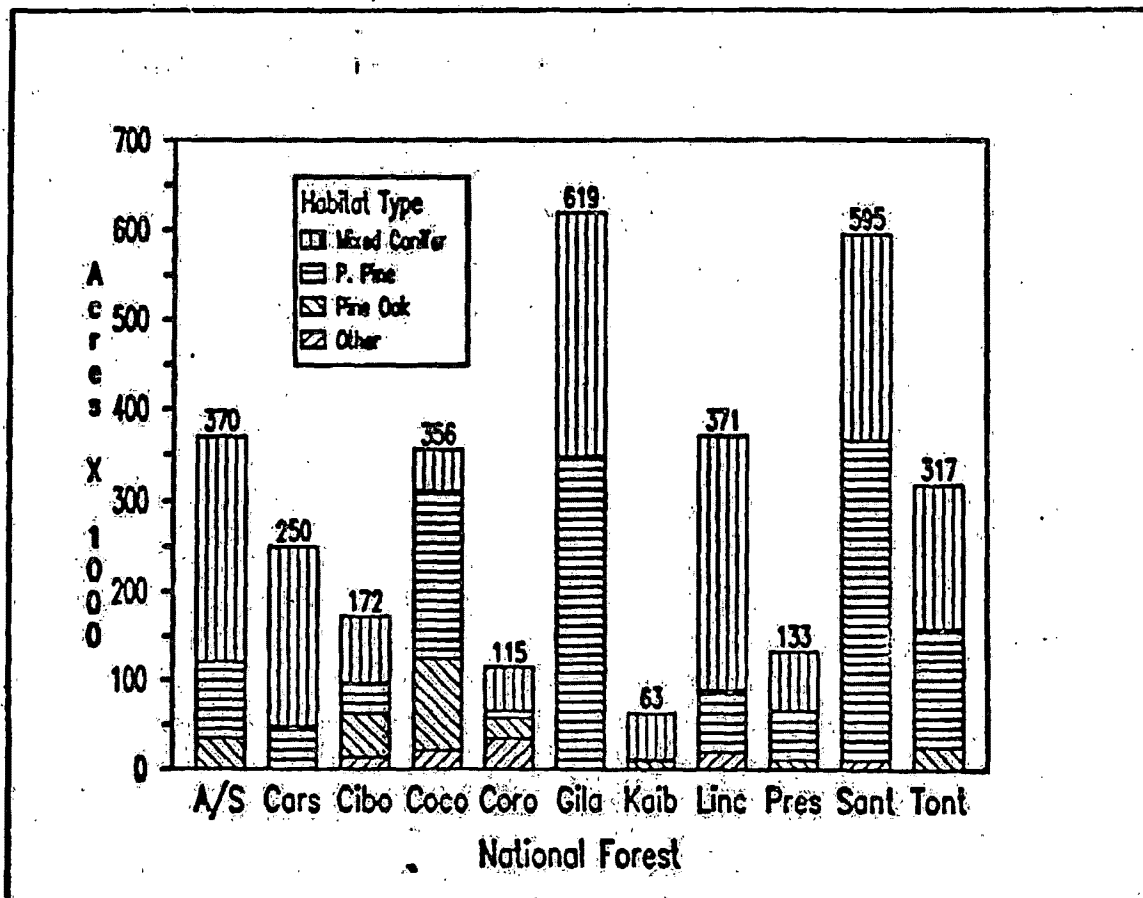


Figure 3. Amount and habitat type of suitable Mexican spotted owl habitat on each National Forest in Arizona and New Mexico.

### Land Status of Suitable Habitat

Land status was grouped into two categories, lands where timber harvest was allowed and lands where timber harvest was not allowed, because several Forests could not break out all of the categories asked for (Fig. 4). Just over 59 percent of the suitable habitat is found on lands where timber harvest is allowed. It is important to note about one-third of the lands where timber harvest is allowed are identified in Forest Plans as not being entered, and that less than 20 percent of the lands available for timber harvest are entered during the first decade of the Plan.

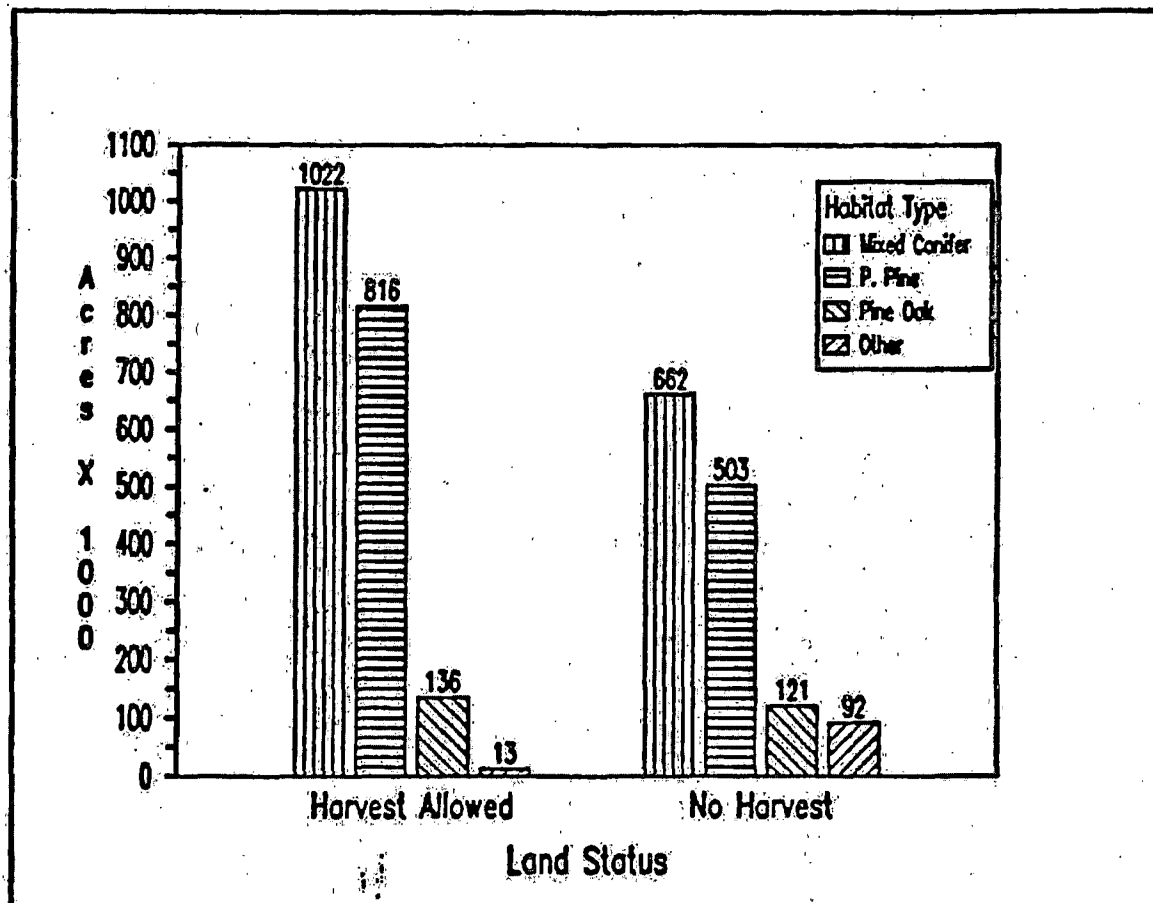


Figure 4. Land status and habitat type of suitable Mexican spotted owl habitat on National Forest lands in Arizona and New Mexico.

### Distribution of Suitable Habitat by Forest

Of the 1.379 million acres of land not available for timber harvest, nearly one-third is on the Gila National Forest (Fig. 5) with the remainder being distributed among the other 10 Forests. The Coronado National Forest has the highest percentage of suitable habitat in lands not available for timber harvest with nearly 94 percent of the Forest not available. The Lincoln has the least amount of land where no timber harvest occurs with just under 13 percent in that category.

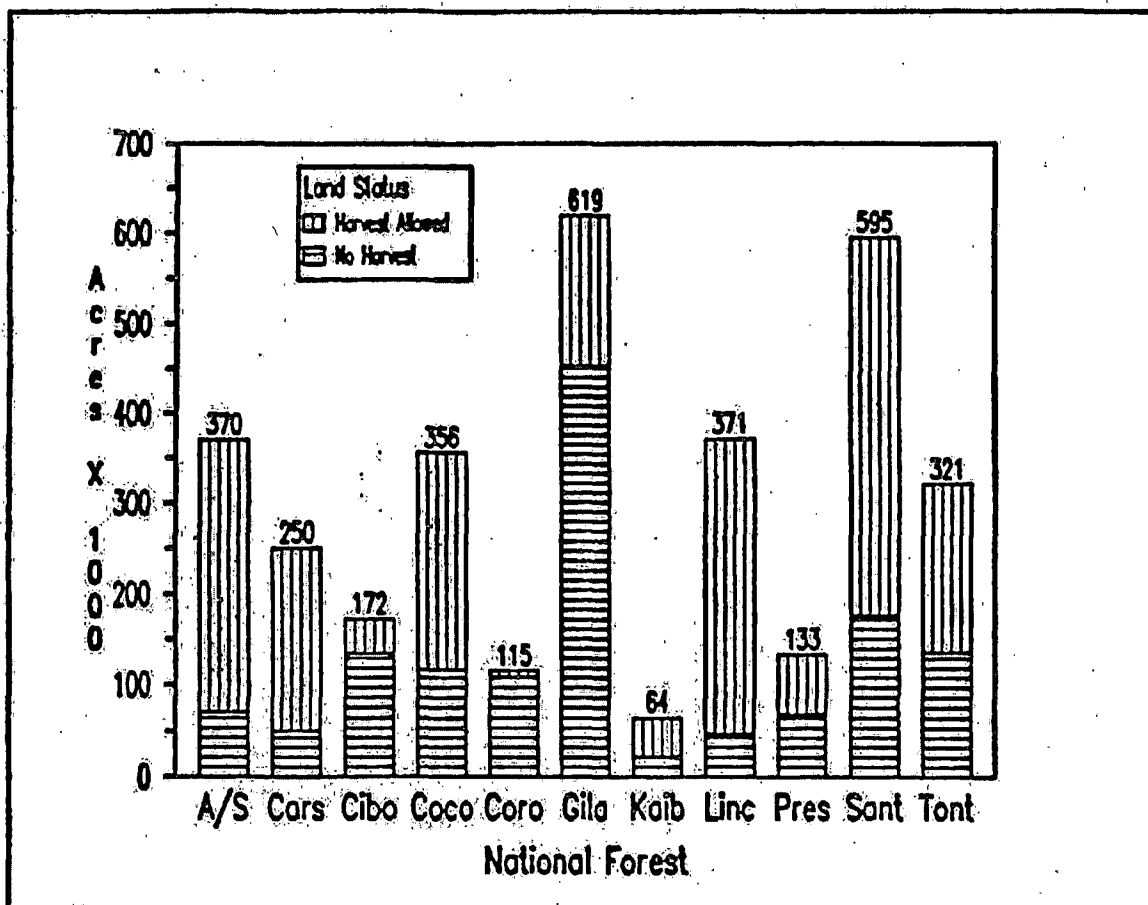


Figure 5. Land status of suitable Mexican spotted owl habitat on each National Forest in Arizona and New Mexico.

## Survey Effort in Suitable Habitat

Over 1.35 million acres of suitable habitat has been surveyed on National Forest lands since intensive spotted owl inventories began in 1988 (Fig. 6). The bulk of the Region's efforts in 1988 and 1989 were on lands where timber harvest was allowed. Increased funding in 1990 allowed over 300,000 acres of land where no harvest was allowed to be inventoried. The amount of mixed conifer and ponderosa pine surveyed is essentially proportional to the amount available for both land classes. A higher percentage of the pine/oak on lands available for timber harvest has been inventoried for owls, and a lower proportion of the other category has been inventoried.

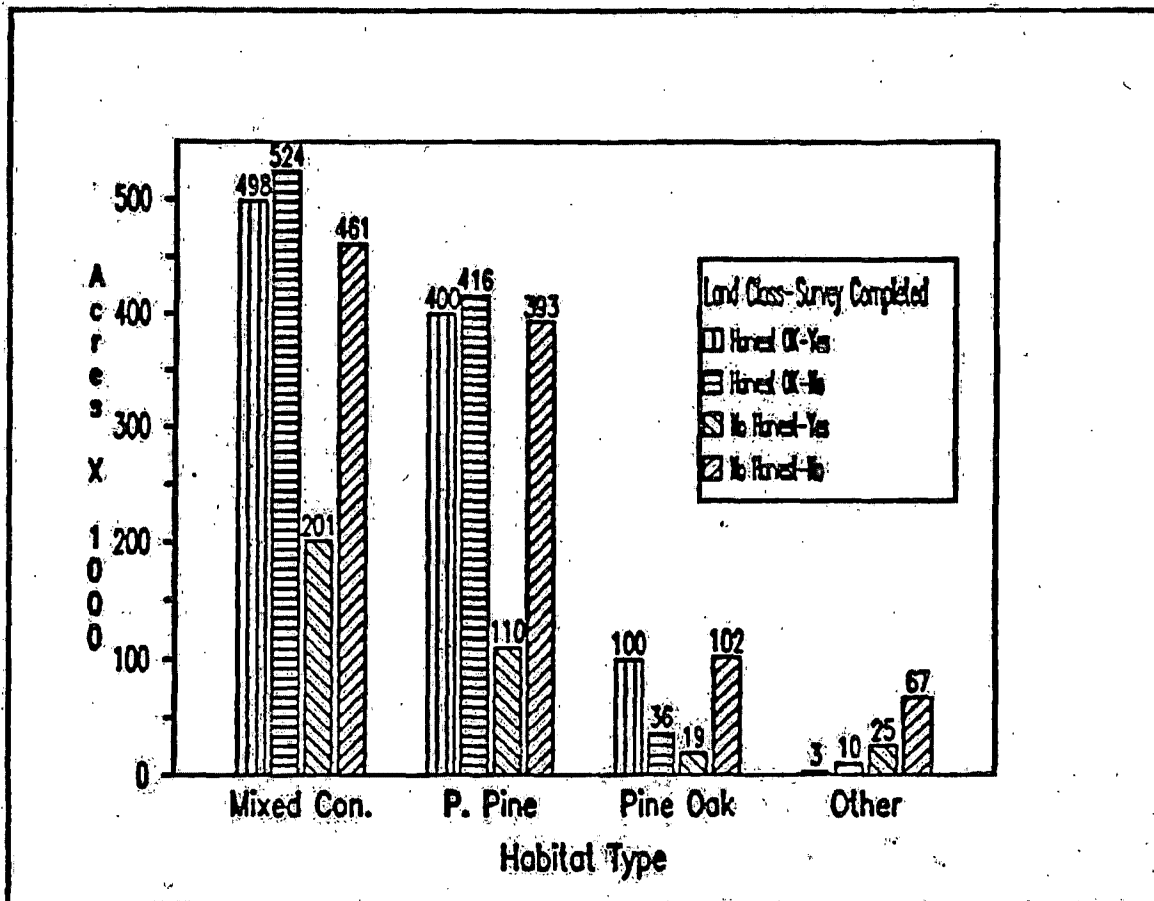


Figure 6. Amount surveyed, habitat type and land status of suitable Mexican spotted owl habitat on National Forest lands in Arizona and New Mexico.

## Capable Habitat

Capable habitat covers over 1 million acres, or nearly 24 percent of all MSO habitat (Fig. 7). Natural events accounted for 21 percent of the capable acres, while man's activities accounted for most of the habitat modifications occurring in MSO habitat.

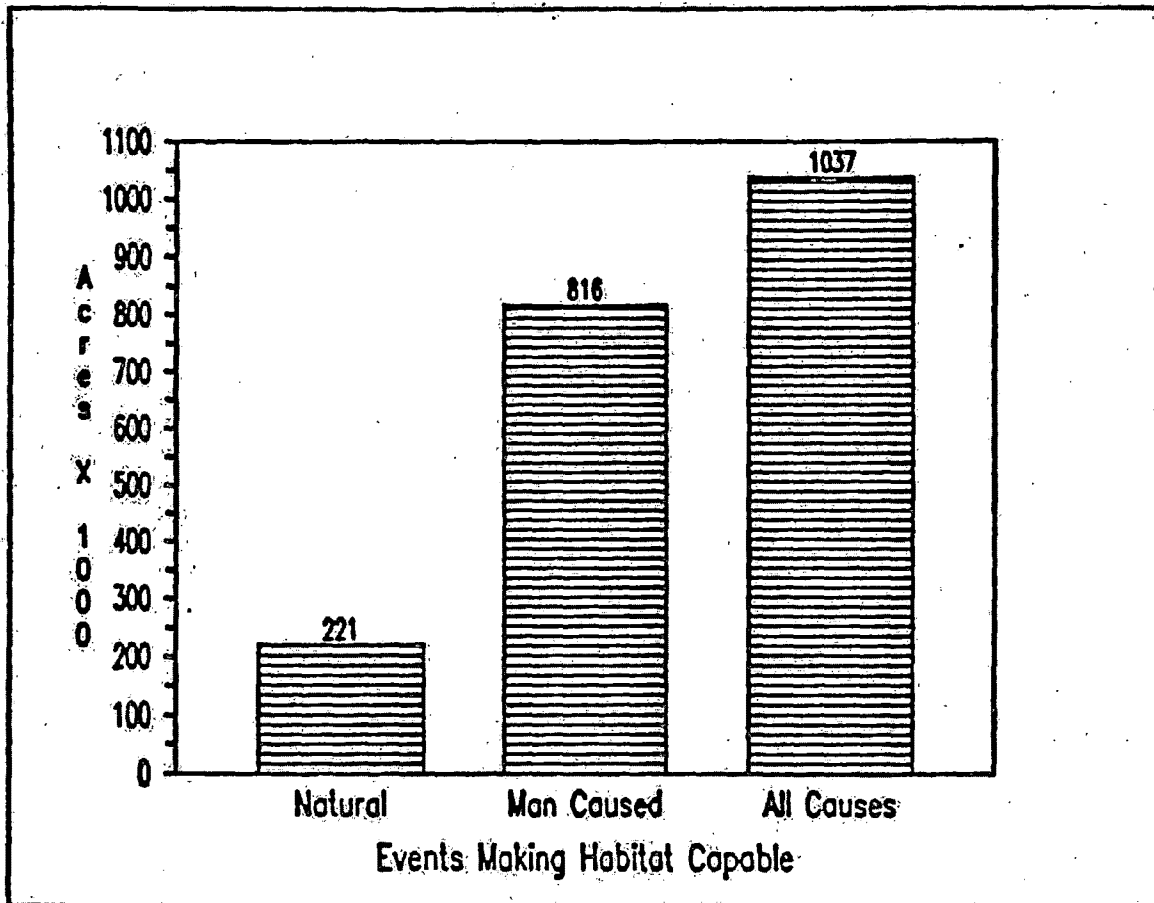


Figure 7. Amount and event making Mexican spotted owl habitat capable on National Forest lands in Arizona and New Mexico.



### Distribution of Capable Habitat

The Apache-Sitgreaves (62%), Coronado (68%), and Lincoln (75%) Forests have the highest proportion of their capable habitat being caused by natural events (Fig. 8). This is just the opposite on the Carson (100%), Cibola (98%), Coconino (96%), Gila (76%), Prescott (91%), and Santa Fe (87%) where over 75 percent of all capable habitat is a result of man's activities.

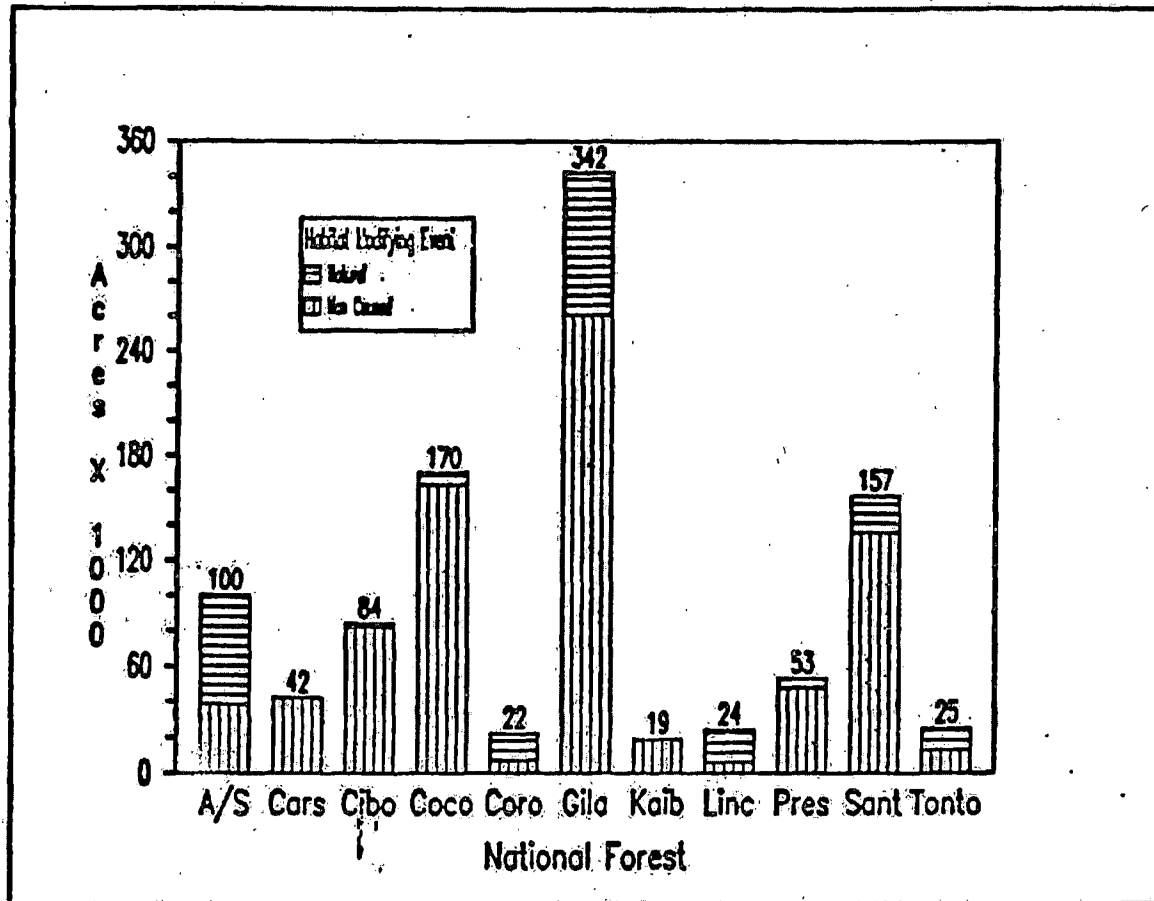


Figure 8. Amount and event making Mexican spotted owl habitat capable on each National Forest in Arizona and New Mexico.

## Events Modifying Suitable Habitat to Capable Habitat

Ponderosa pine types make up the majority of the acres of capable habitat for both types of events making habitat capable (Fig. 9). Although this should be expected for man-caused modifications since past harvest activities have been limited to slopes generally less than 40 percent, it is significant at the 97.5 percent level for natural events ( $\chi^2=6.4$ ,  $n=1$ ) and at the 99.5 percent level for man's activities ( $\chi^2=10.0$ ,  $n=1$ ) when compared to the amount of suitable habitat available for the habitat type. Mixed conifer was modified less than would be expected for both events ( $\chi^2=8.0$ ,  $n=1$ ), significant at the 99.5 percent level. Hardwoods were modified more frequently than would be expected by natural events ( $\chi^2=21.0$ ,  $n=1$ ), significant at the 99.5 percent level.

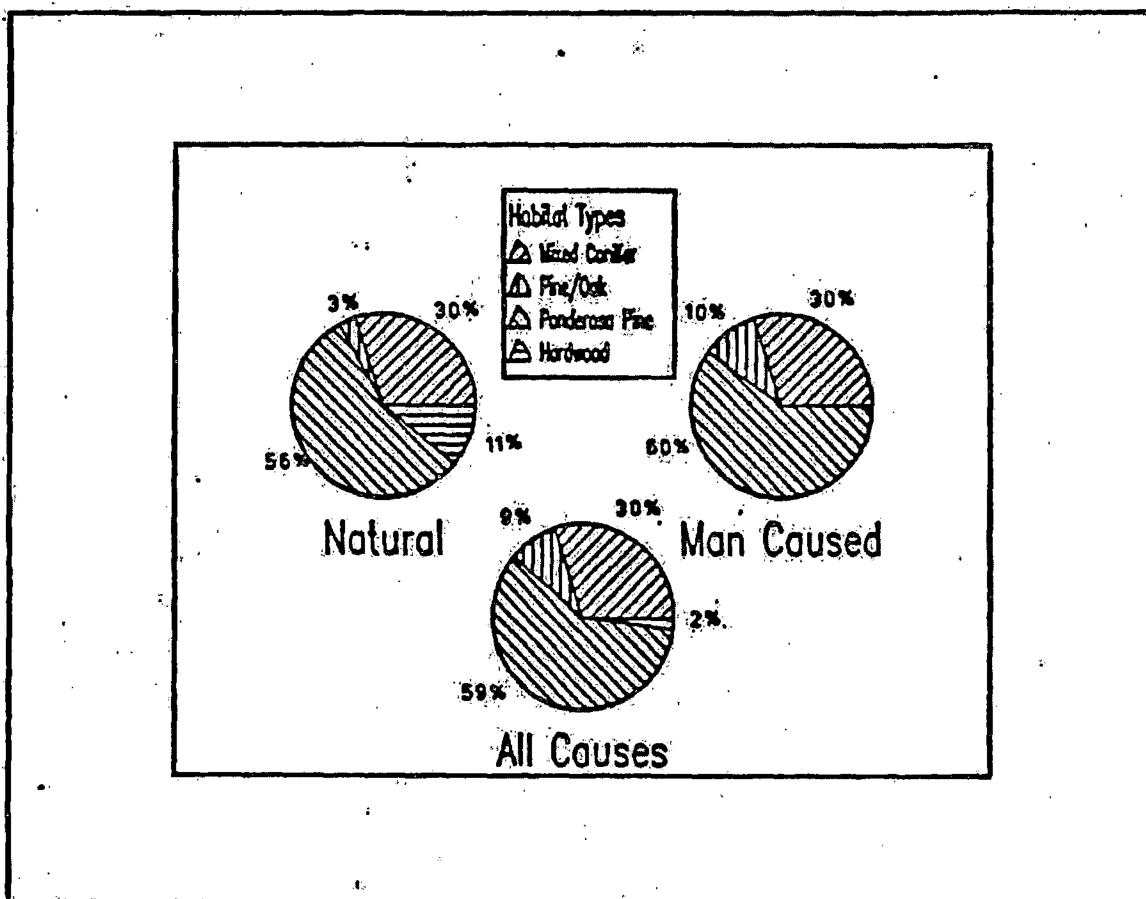


Figure 9. Percentage of habitat types in each category of event making Mexican spotted owl habitat capable on National Forest lands in Arizona and New Mexico.

### Length of Time Until Capable Habitat Becomes Suitable

Approximately one-fifth of the capable habitat for both natural events and man's activities will take less than 50 years until it is again providing suitable MSO habitat (Fig. 10). Natural events tend to modify suitable habitat more severely than man's activities, as indicated by nearly 62 percent of natural events taking more than 100 years to return to suitable, while 44 percent of man-caused modifications will take more than 100 years to again provide suitable habitat.

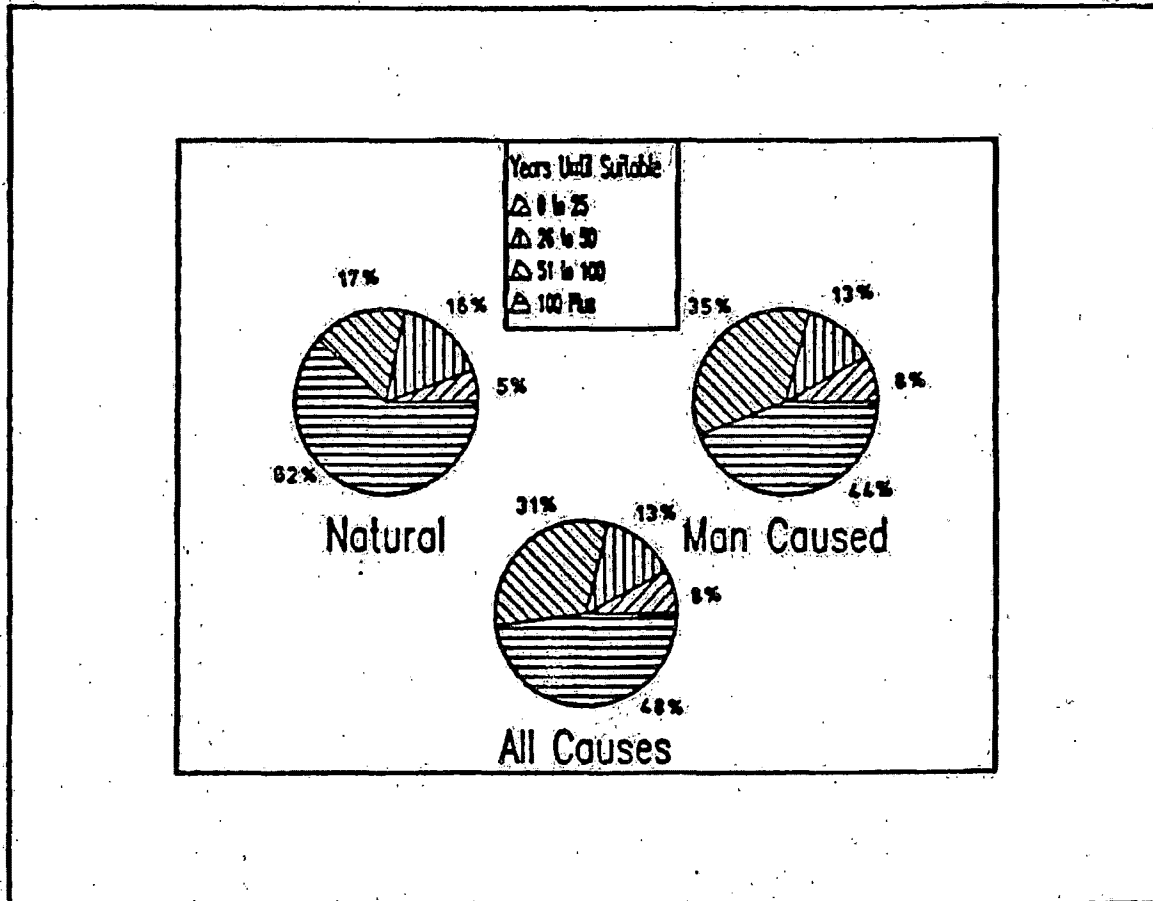


Figure 10. Length of time it will take for each type of event making up capable Mexican spotted owl habitat to become suitable habitat on National Forest lands in Arizona and New Mexico.

## MSO Habitat on Non-Federal Lands

Collins (1989) and Van Hooser (1989 and 1990) mapped and identified the amount of timberland outside of National Forest lands for New Mexico and Arizona. Figure 11 summarizes the acreages of mixed conifer and ponderosa pine habitat types for northern and southern New Mexico and Arizona. The distribution of timberland by county suggests most of the acreage figures for Arizona in Figure 11 are associated with the White Mountain Apache, San Carlos Apache, and Navajo Reservations and state and private land within and around the Apache-Sitgreaves, Coconino, and Tonto National Forests. Acreage values were available for southern New Mexico and the entire state. Nearly all of the southern New Mexico figures were associated with the Mescalero Apache Reservation and private inholdings within the Lincoln National Forest. The northern New Mexico picture is less clear, as county figures indicate major areas of timberland were associated with the Navajo, Jicarilla Apache, and Zuni Reservations and private and state lands within and around the Carson and Santa Fe National Forests.

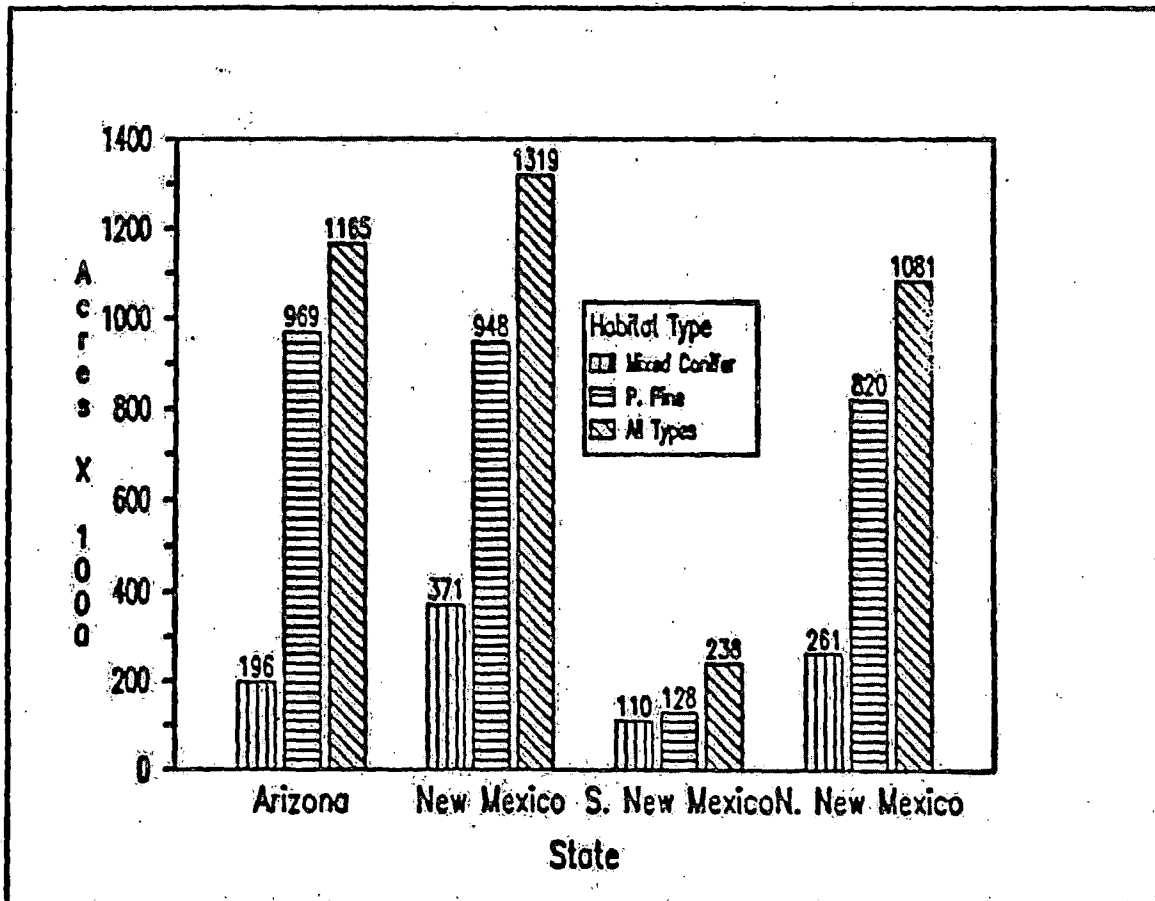


Figure 11. Amount of mixed conifer and ponderosa pine habitat types on private, reservation and state lands in Arizona and New Mexico.

To better estimate the amount of MSO habitat on these lands, I used the proportions of mixed-conifer, ponderosa pine, and pine/oak types for suitable MSO habitat on National Forest lands to approximate the amount on non-Federal lands; mixed conifer equals 50 percent, ponderosa pine equals 40 percent, and pine/oak equals 7 percent. I did not estimate an acreage for other types. Figure 12 provides the acreages calculated for each of these types. I assumed all identified mixed conifer was suitable MSO habitat, and this was equal to 50 percent of the MSO habitat on non-Federal lands in the two states.

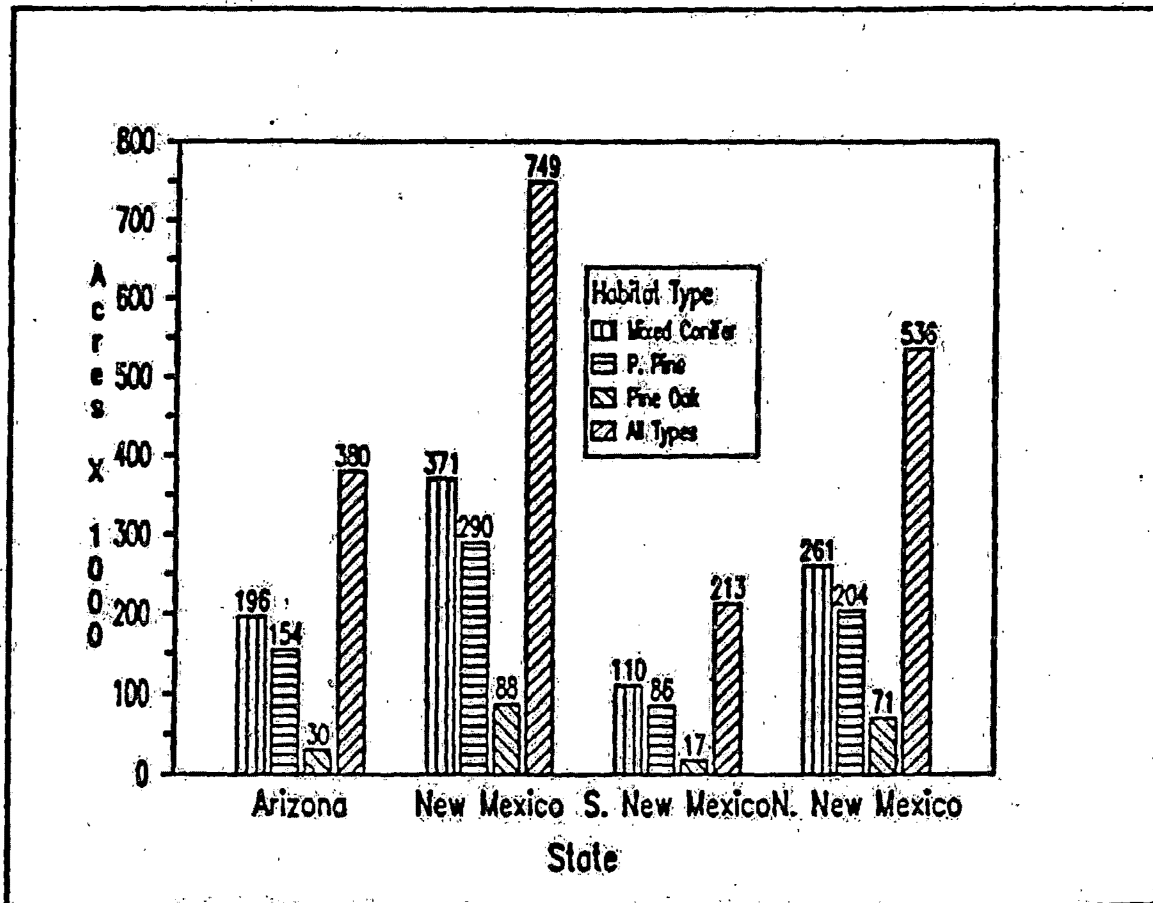


Figure 12. Amount of Mexican spotted owl habitat by habitat type on private, reservation and state lands in Arizona and New Mexico.

## **MSO Habitat In Regions 2 and 4, Colorado and Utah**

The amount of MSO habitat has been estimated for the National Forests in Colorado and Utah. The Forests of Colorado have estimated over 1.1 million acres of suitable habitat exists based on Region 3's definition. Of this amount, about 20 percent has been surveyed. Four sites have been established where spotted owls are located. Utah Forests have estimated over 480,000 acres is suitable. Only 4 percent of their lands have been surveyed. They have located three sites where Management Territories would likely be established if an activity were to occur in the area.

## Characteristics of MSO Nest Sites (Trees and Ledges)

Site data were collected in sufficient detail at 22 nest sites throughout the Region to analyze. Sixteen of the nest sites were in mixed-conifer types (Fig. 13). Proportionate use is significant ( $\chi^2=10.6$ ,  $n=1$ ) at the 99.5 percent level when compared with availability of mixed-conifer types (Fig. 1). The same is true for pine/oak ( $\chi^2=17.3$ ,  $n=1$ ) and riparian ( $\chi^2=12.0$ ,  $n=1$ ) when compared to the availability of pine/oak and the "other" category of habitat types. It is noteworthy that no nests were found in ponderosa pine even though it makes up 40 percent of the suitable habitat.

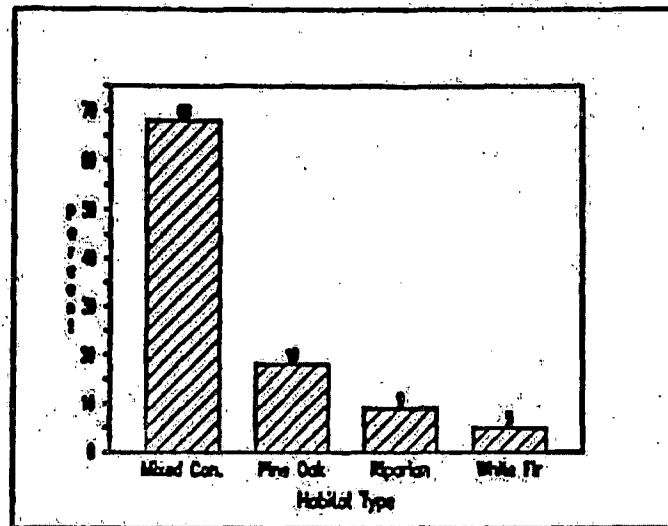


Figure 13. Forest type of 22 nest trees characterized on National Forest lands in Arizona and New Mexico.

Over a third of the nests were in a tree cavity, primarily in Gambel oak (Fig. 14). Nests in witches broom or on stick platforms each provided nearly one-third of the types of substrate where a nest was found.

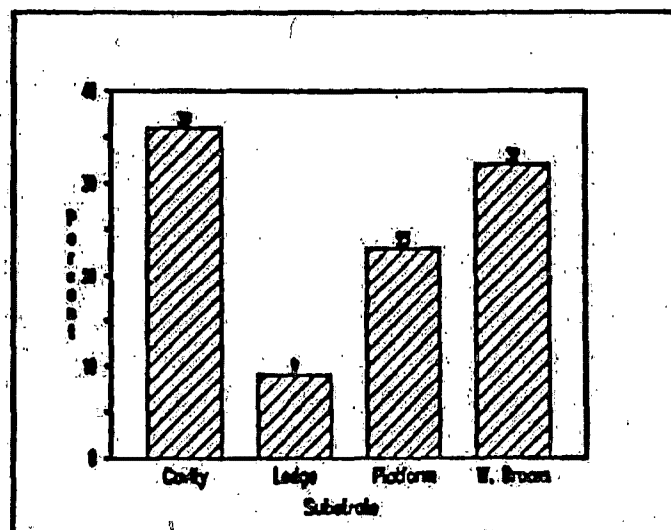


Figure 14. Substrate used for 22 nests characterized on National Forest lands in Arizona and New Mexico.

### Nest Tree Characteristics

Generally the trees used had a moderate-to-large diameter and height for the species used, except ponderosa pine, which were smaller in diameter, averaging under half the mean diameter of all trees used (Fig. 15). Douglas-fir trees made up nearly half the ones used, and Gambel oak were used at over one-third of the sites. Most nests were in the upper half of the tree.

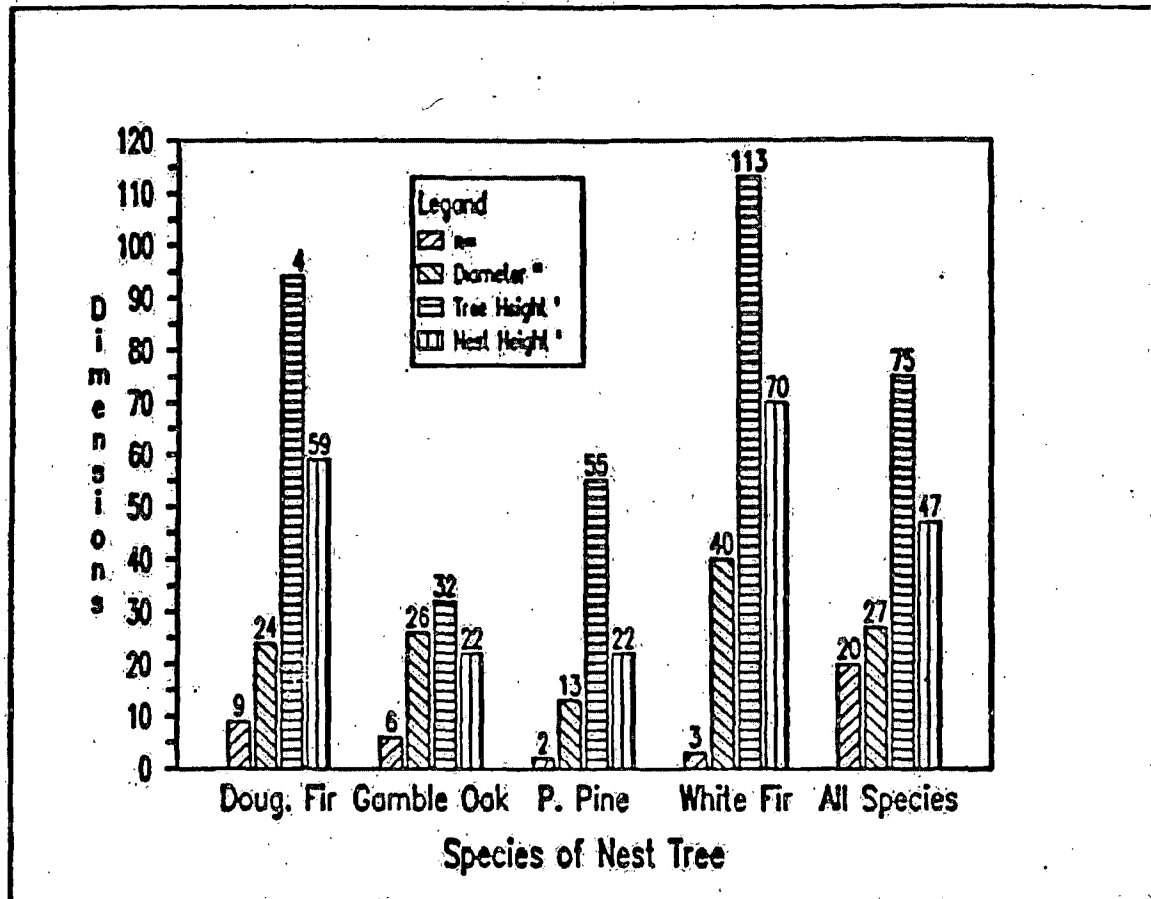


Figure 15. Mean dimensions of 20 nest trees used by Mexican spotted owls on National Forest land in Arizona and New Mexico.

Slope (Fig. 16), aspect (Fig. 17), elevation (Fig. 18), and slope position (Fig. 19) at the nest trees indicates most were located on moderate to steep slopes, facing in a northerly or easterly direction, on the lower third of the hillside between 6,000 and 8,000 feet elevation. These data support similar findings reported in Ganey, et al (1988).



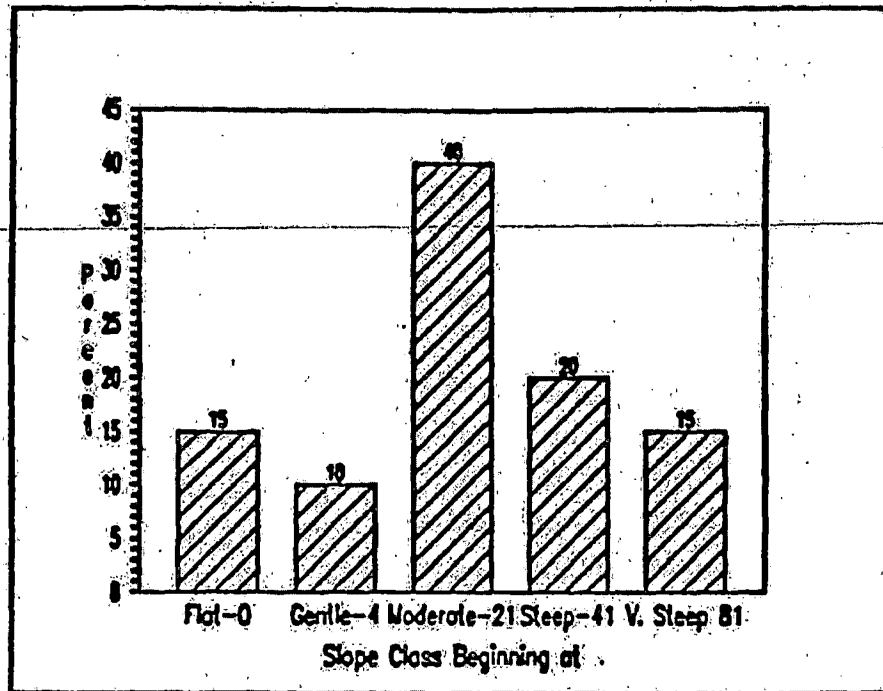


Figure 16. Slope at 20 nest trees used by Mexican spotted owls on National Forest land in Arizona and New Mexico.

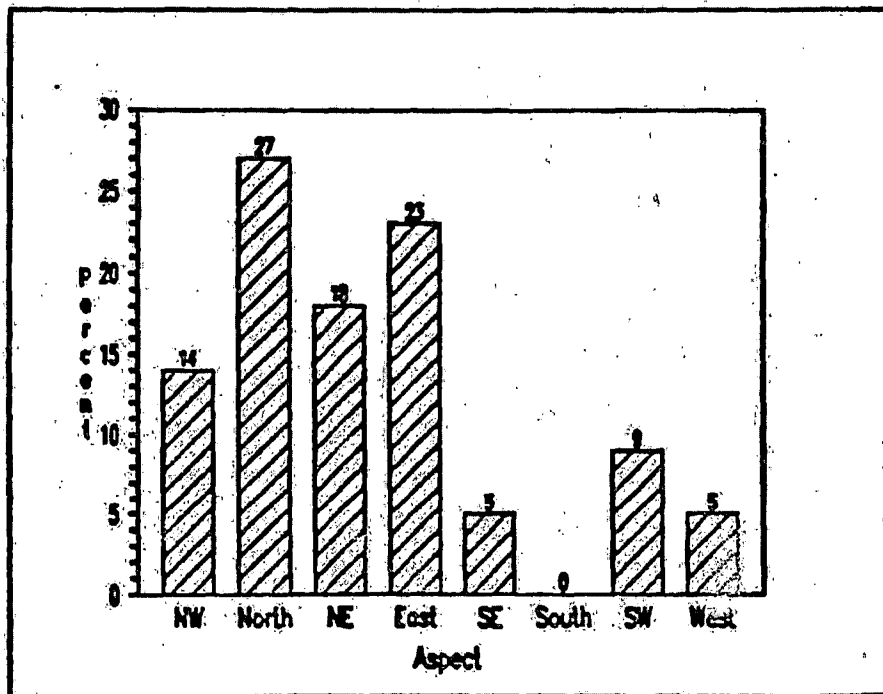


Figure 17. Aspect at 20 nest trees used by Mexican spotted owls on National Forest land in Arizona and New Mexico.

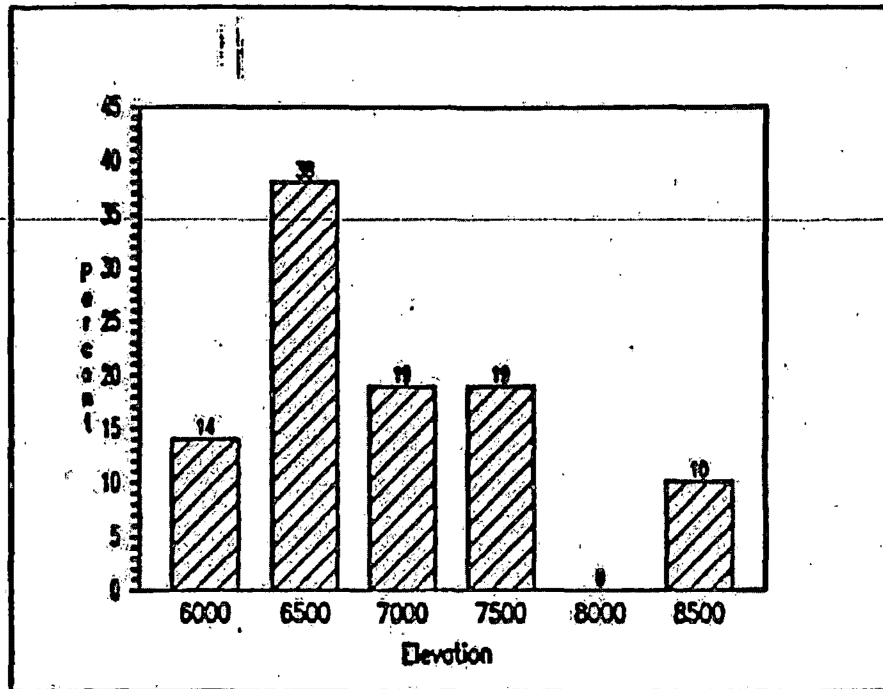


Figure 18. Elevation at 20 nest trees used by Mexican spotted owls on National Forest land in Arizona and New Mexico.

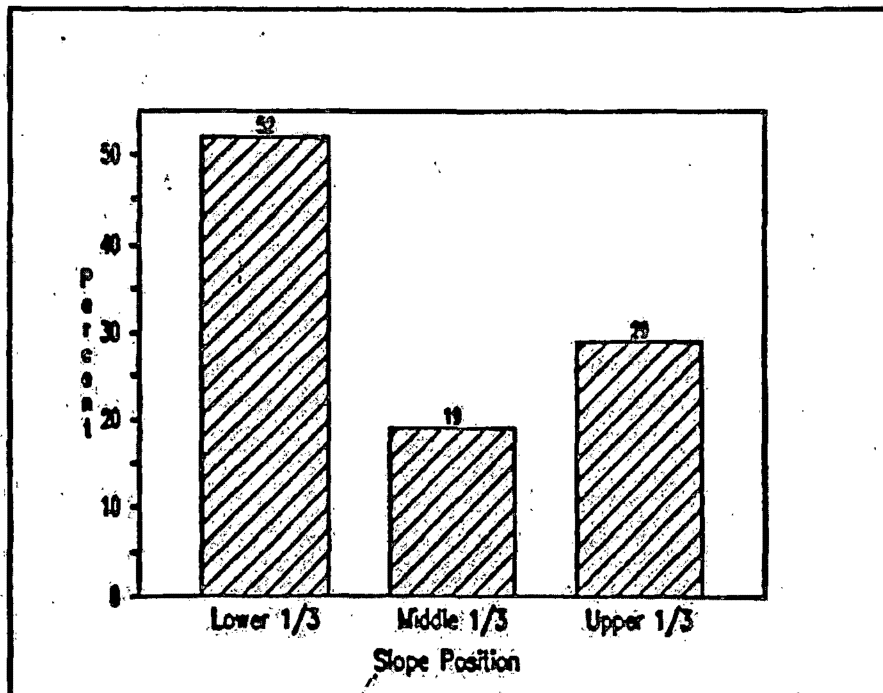


Figure 19. Slope position at 20 nest trees used by Mexican spotted owls on National Forest land in Arizona and New Mexico.

## Characteristics of MSO Day Roost Trees

Site data were collected in sufficient detail at 83 day roost sites throughout the Region to analyze. Seventy-four of these sites were in mixed-conifer types (Fig. 20). Proportionate use is significant ( $\chi^2=16.8$ ,  $n=1$ ) at the 99.5 percent level when compared with availability of mixed-conifer types (Fig. 1). The same is true for pine/oak ( $\chi^2=20.6$ ,  $n=1$ ) when compared to the availability of the pine/oak habitat type. Ponderosa pine was used less than expected for roost sites ( $\chi^2=38.0$ ,  $n=1$ ) when compared with its availability.

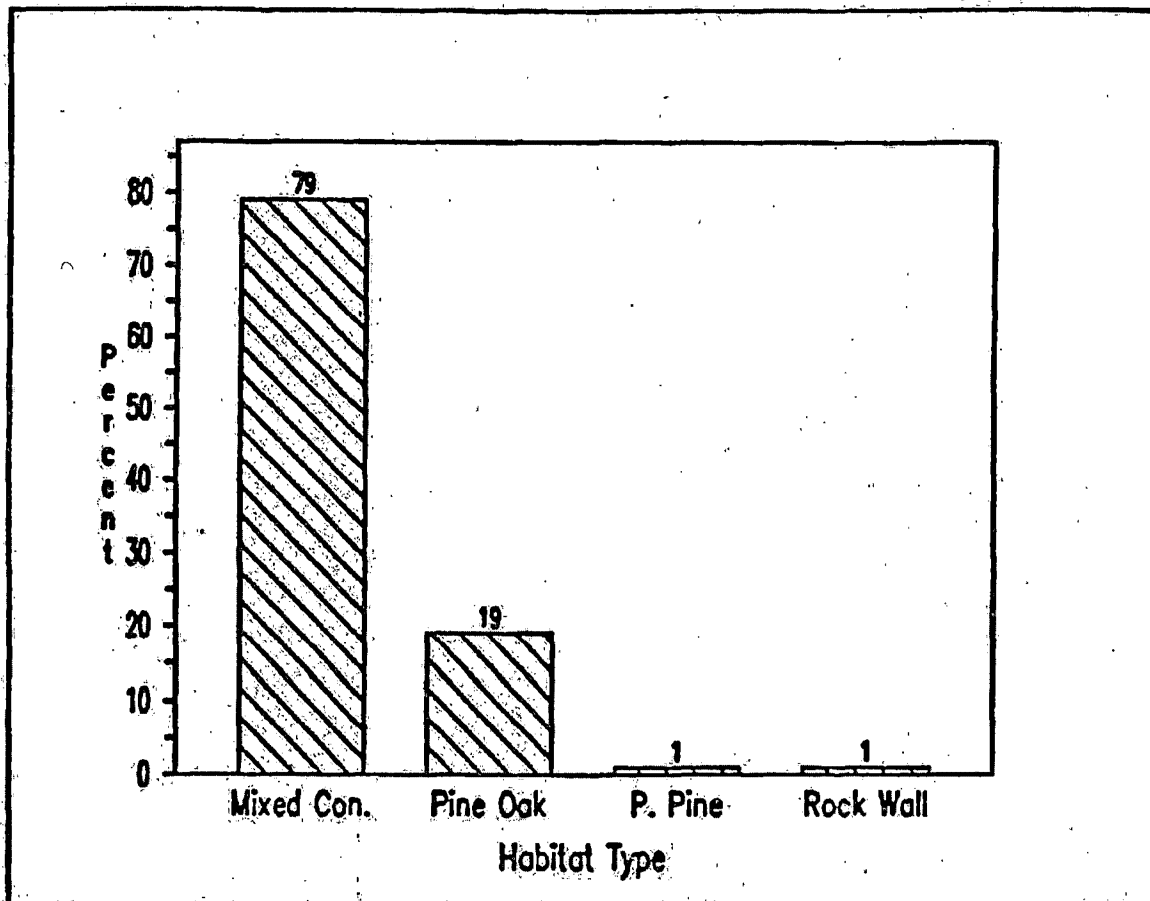


Figure 20. Forest type of 83 day roost trees characterized on National Forest lands in Arizona and New Mexico.

Generally, the trees used as day roosts were small diameter and moderate height for the species used (Fig. 21). Douglas-fir trees made up over one-third of the trees used while Gambel oak and ponderosa pine each made up about one-fifth of the trees used as roosts. Most day roosts were in the lower third of the tree.

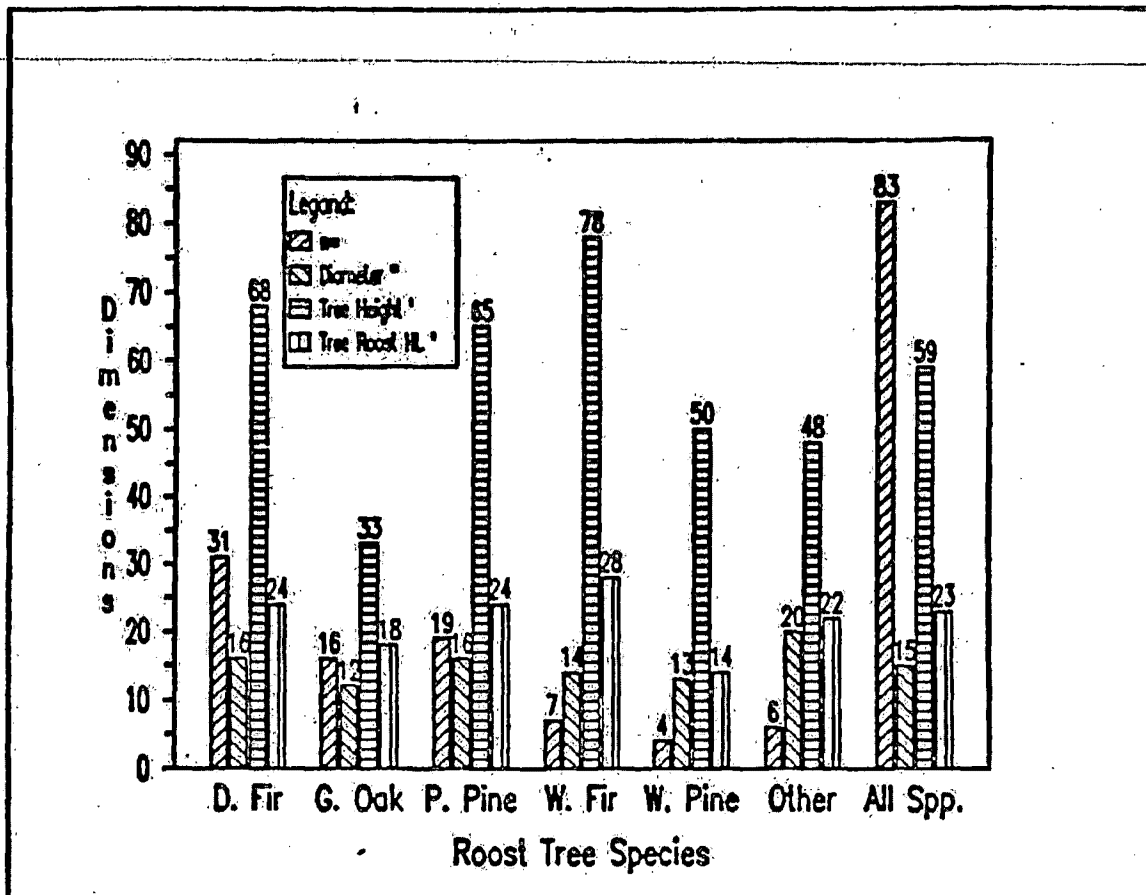


Figure 21. Mean dimensions of 84 day roost trees used by Mexican spotted owls on National Forest land in Arizona and New Mexico.

Slope (Fig. 22), aspect (Fig. 23), elevation (Fig. 24), and slope position (Fig. 25) at the nest trees indicates most were located on gentle to steep slopes, facing in a northerly direction, on the lower third of the hillside between 6,000 and 9,000 feet elevation.

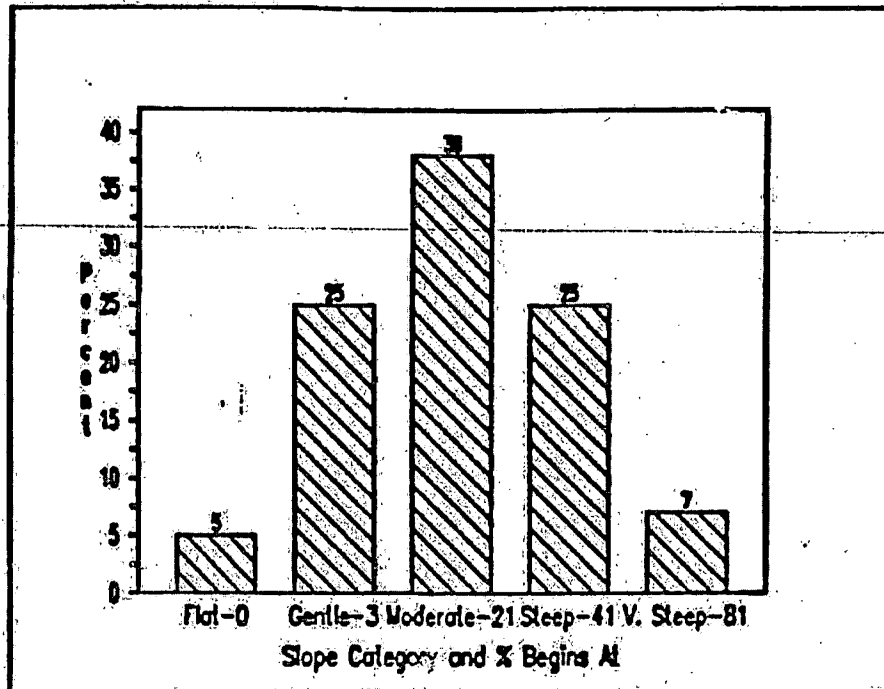


Figure 22. Slope at 84 day roost trees used by Mexican spotted owls on National Forest land in Arizona and New Mexico.

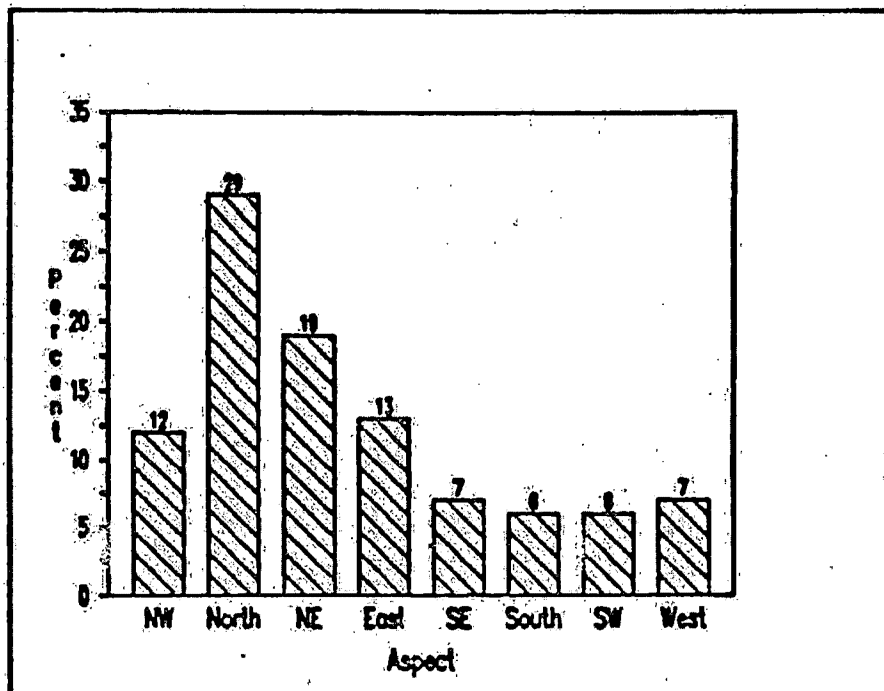


Figure 23. Aspect at 84 day roost trees used by Mexican spotted owls on National Forest land in Arizona and New Mexico.

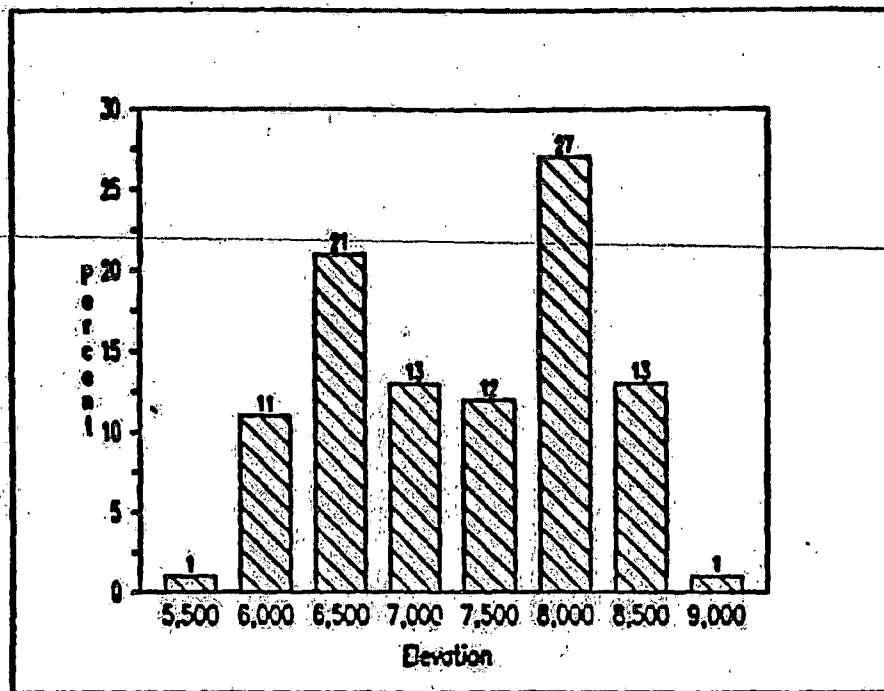


Figure 24. Elevation at 84 day roost trees used by Mexican spotted owls on National Forest land in Arizona and New Mexico.

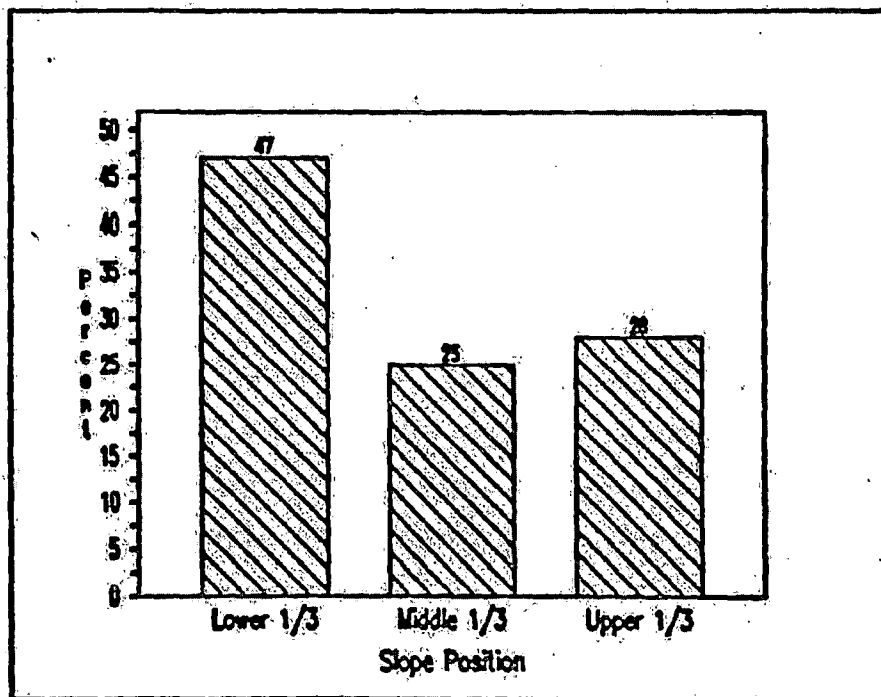


Figure 25. Slope position at 84 day roost trees used by Mexican spotted owls on National Forest land in Arizona and New Mexico.

## MSO Abundance and Distribution

A total of 517 Management Territories has been established around locations of spotted owls detected during calling surveys (Fig. 26). Nearly 49 percent of these have nest and/or day roost sites located to aid in establishing the territory and core area boundaries. The remaining sites relied totally on the nighttime calling locations and professional judgment of the District Wildlife Biologist in establishing the boundary (see ID No. 2 for a more detailed description of calling surveys and territory establishment procedures).

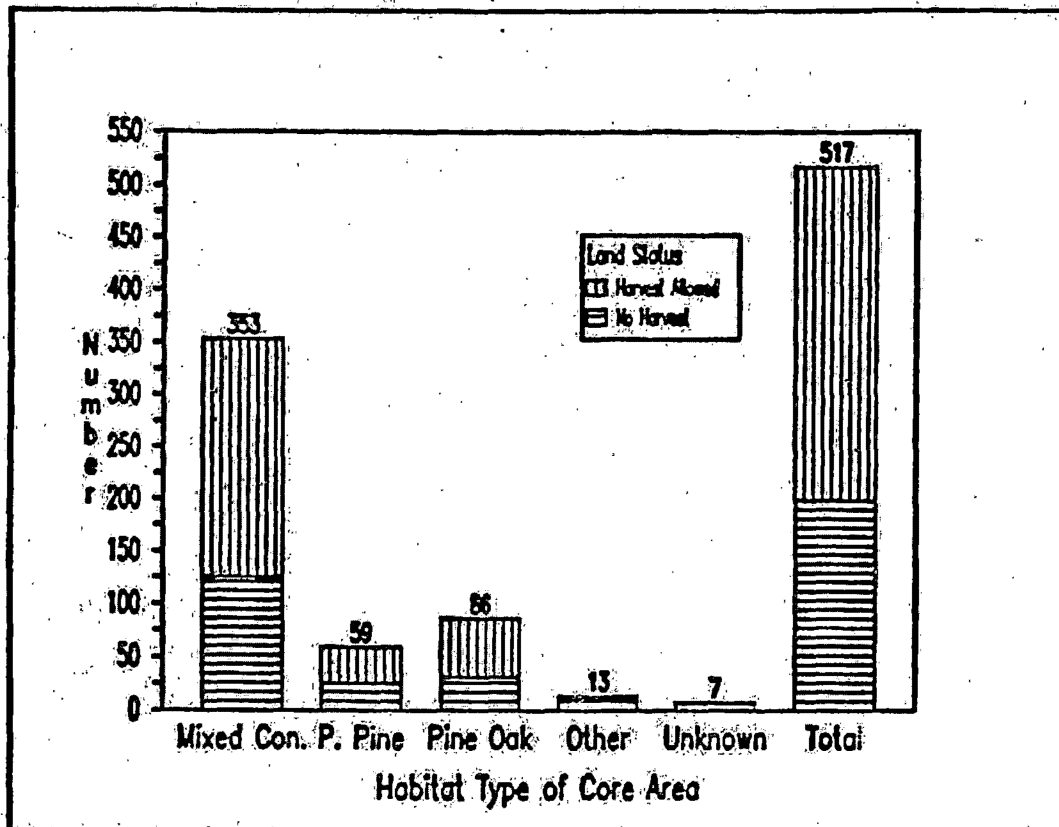


Figure 26. Land status and habitat type of the core area for the 517 MSO Management Territories established on National Forest Lands in Arizona and New Mexico.

Based on the proportion of suitable habitat available (Fig. 26), mixed conifer ( $\chi^2=37.7$ ,  $n=1$ ) and pine/oak ( $\chi^2=69.4$ ,  $n=1$ ) types were used significantly more often than would be expected, significant at the 99.5 percent level. Furthermore, ponderosa pine types ( $\chi^2=103.1$ ,  $n=1$ ) were used significantly less than would be expected, significant at the 99.5 percent level. The "other" category of habitat types were used in proportion to available habitat.

Figure 27 summarizes the number of Territories by land status on each National Forest. The Coconino (56%), Coronado (99%), Carson (100%), and Kaibab (100%) had a higher proportion of Territories in areas where no harvest is allowed than the other Forests. The Territories on the Lincoln, Prescott, and Santa Fe are all or essentially all within areas where harvest is allowed.

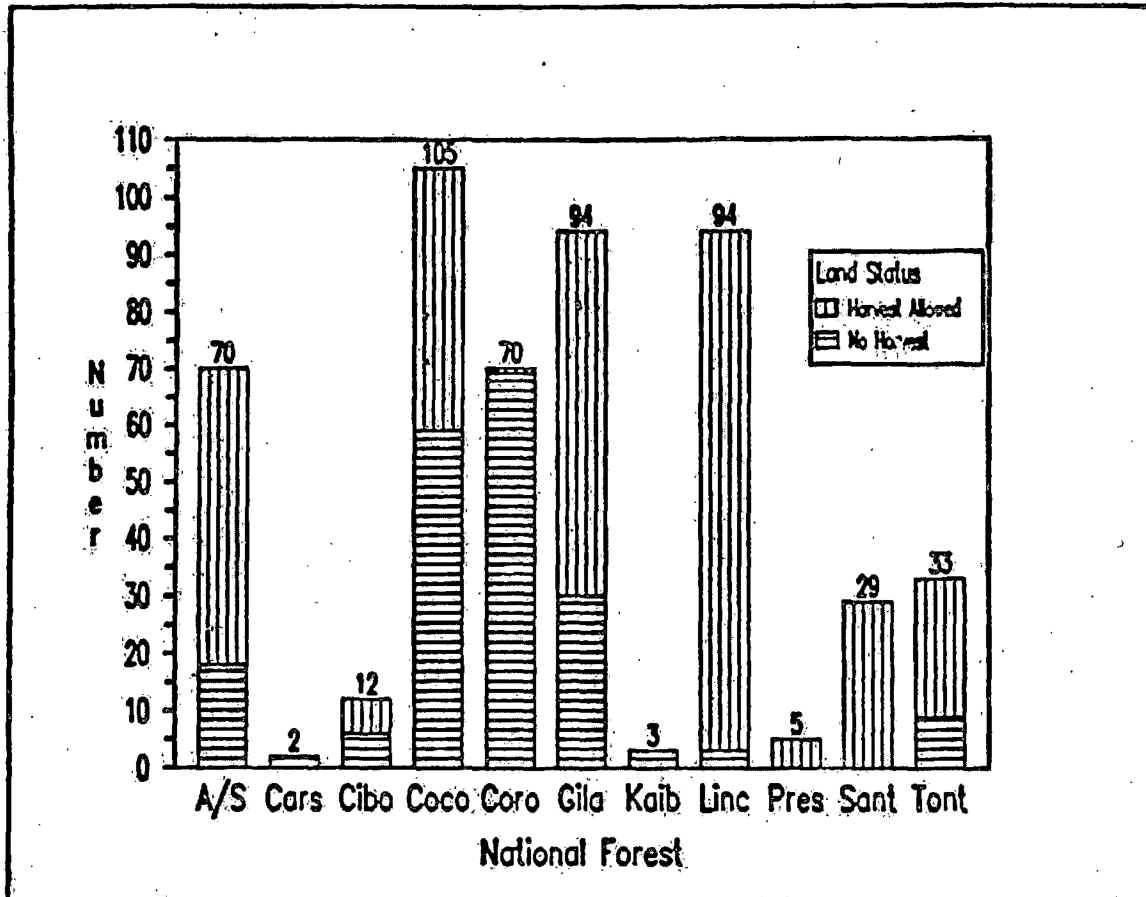


Figure 27. Land status of the core area for the MSO Management Territories established on each National Forest in Arizona and New Mexico.

Figure 28 provides the number of Management Territories established, the acreage of suitable MSO habitat, and the percentage surveyed for each National Forest in Arizona and New Mexico and cumulative totals for Colorado and Utah.



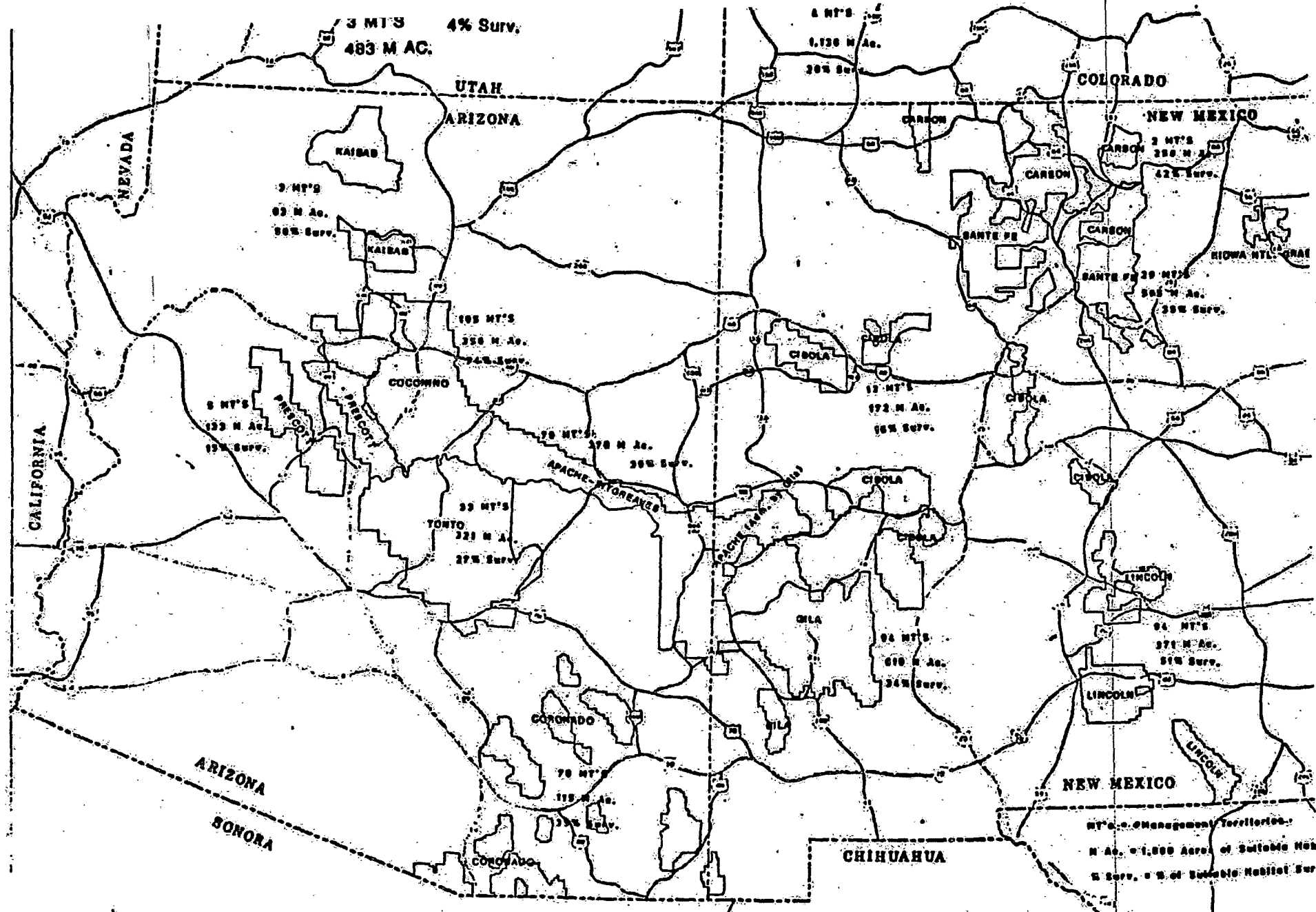


Figure 28. Distribution of Mexican spotted owl Management Territories and habitat on National Forest Lands in the Southwest.

## Management Direction

ID No. 2 provides specific direction on locating, establishing, monitoring, and managing a Management Territory wherever a Mexican spotted owl is located. The management direction portion was established using Ganey's (1987) telemetry data on home range and habitat use. The intent of ID No. 2 is to establish a 2,000-acre or larger Territory with at least a 450-acre core area. The 2,000 acres was reduced to 1,500 acres on the Gila and Lincoln National Forests based on relative densities of owls for these areas and a need to maintain community stability. No activities are allowed in the core area, except road building and then only if no other route is feasible. Restrictions on use may be applied during the breeding season if an activity would likely affect reproductive efforts. Activities are defined as any action authorized by the Forest Service that would modify habitat so it was no longer suitable or adversely affect reproductive efforts.

Generally no more than 516 acres of activities are allowed in a Management Territory (500 acres on the Lincoln and Gila). The ID does allow exceptions to go up to 775 acres on occasion and for compelling reasons (except Lincoln and Gila). All capable habitat within the Management Territory is included in the 516-acre activity area. New entries into suitable habitat are not allowed unless an exception is granted if more than 516 acres of capable habitat exists within a Territory.

The intent of the Management Territory is to maintain at least a 450-acre core area, a minimum of 1,000 acres of suitable habitat after an activity is completed, and as large of a block of contiguous suitable habitat as possible (preferably 600 acres or more).

If a spotted owl is found after a sale is sold or activity authorized, only the core area restrictions are applied. All activities within the core area would be moved out of the core area. If it is not possible to replace these activities outside the core area, they are dropped from further consideration.

Prior to issuing ID Nos. 1 and 2, the R3 Wild model was used to provide a comparative index on the effects of management activities on spotted owl habitat. Because this model does not display actual effects, it is being replaced with an actual effects assessment on each Management Territory and a cumulative effects analysis if any adverse effects are found for any Management Territory.

## Habitat within MSO Management Territories

An analysis of 359 Management Territories is summarized in Figure 29. Though the average size exceeds the minimum recommended in ID No. 2 by 55 acres, the range in Territory size of 1,458 to 2,969 acres indicates some of the Territories are less than the recommended 2,000 acres (Table 1). Only one of the Territories with new activities being proposed is less than the 2,000 acres. The other Territories are in areas with no activities proposed; the actual Territory boundary had not been established, or it made no sense to include more acres of unsuitable habitat just to get to 2,000 acres. Although not every Territory meets the intent of ID No. 2, the average values for every Forest (Figs. 31-40) except the Coronado, Gila, and Prescott exceed the intended suitable, contiguous block and core size.

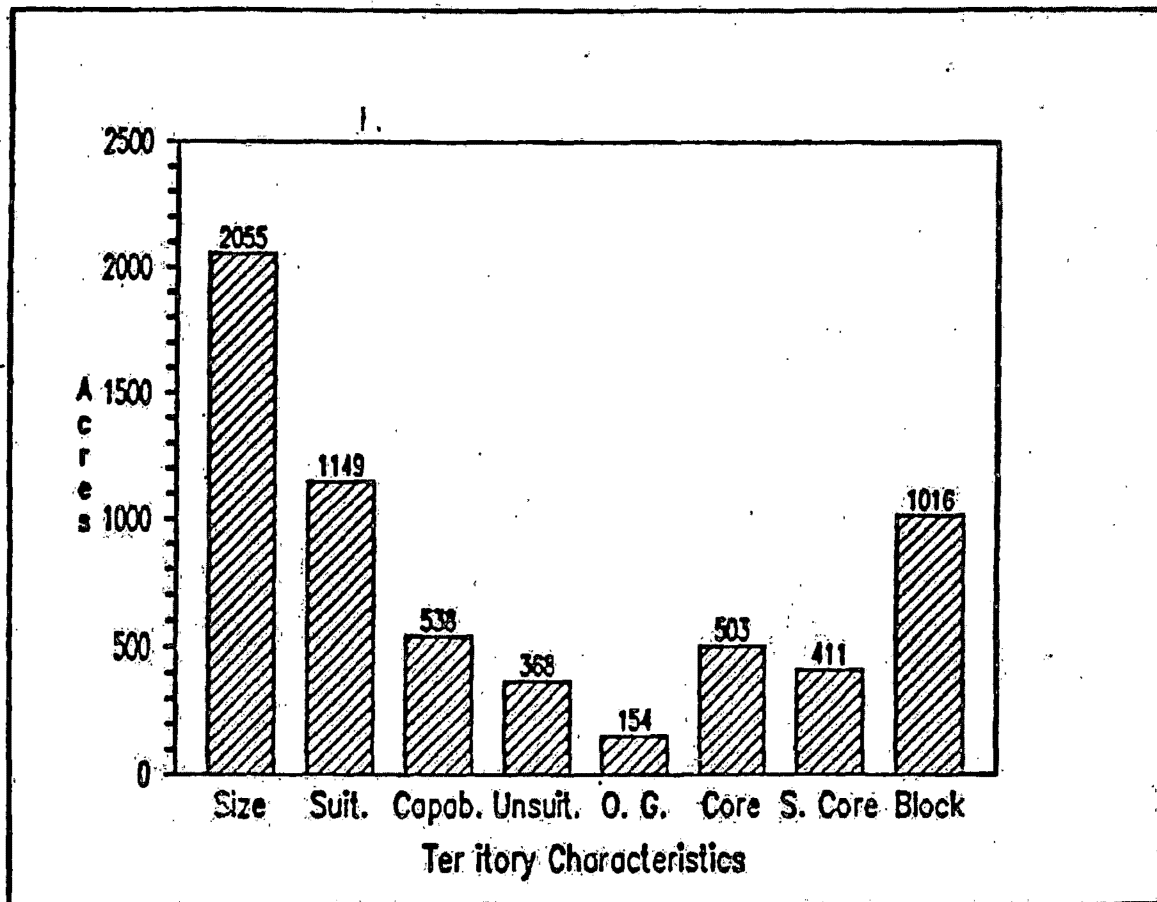


Figure 29. Mean characteristics of 359 Mexican spotted owl Management Territories on National Forest lands in Arizona and New Mexico.

### Management Territory Characteristics for Three Levels of Activities

Figure 30 provides a comparison of the mean values of characteristics of Management Territories having had no activities occur in them, ones where old activities had occurred, but no new ones are proposed in the near future, and Territories where new activities are occurring or are proposed. The level of activity does not necessarily equate to areas where timber harvest is allowed or not allowed, although most of the Management Territories which have had no activities are also found where no timber harvest occurs. This is not the case with areas where past activities have occurred. Here, Territories occur in both areas where no timber harvest occurs and areas where timber harvest is allowed. The Management Territories where new activities are occurring or proposed represents what is going on in the territories since ID No. 1 was implemented in June 1989.

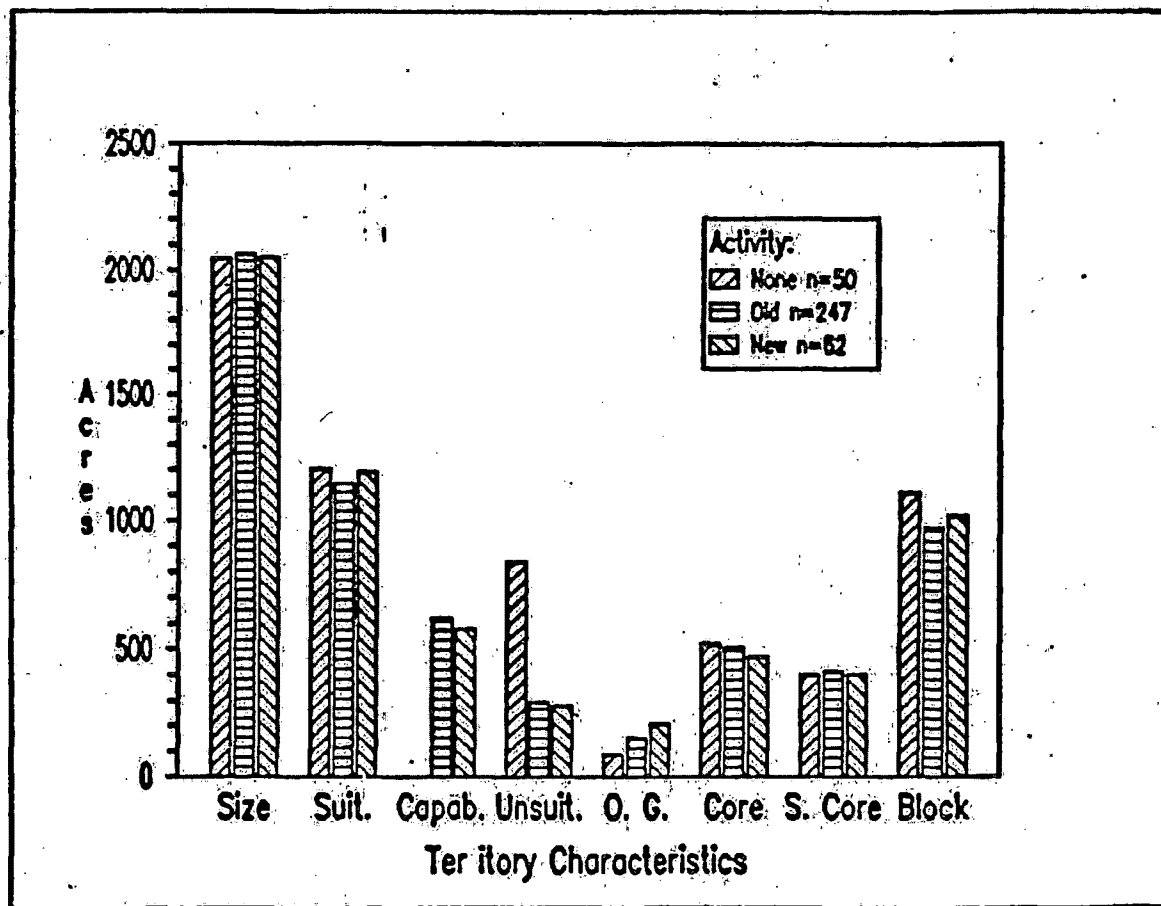


Figure 30. A comparison of the mean characteristics of Mexican spotted owl Management Territories found on National Forest lands in Arizona and New Mexico where no activities have occurred, only past activities have occurred and where new activities are proposed or have been implemented.

**Table 1. Mean, standard error (SE), maximum and minimum values of characteristics of Mexican spotted owl Management Territories for Territories where no activities have occurred in the past, old activities have occurred but new ones are not proposed in the near future, new activities are proposed and for all Management Territories.**

<b>Activity In Management Territory</b>	<b>Amount of Territory Size</b>	<b>Amount of Suitable Habitat</b>	<b>Amount of Capable Habitat</b>	<b>Unsuitable Habitat</b>	<b>Amount of Old Growth</b>	<b>Core Size</b>	<b>Amount of Suitable In Core</b>	<b>Contiguous Block of Suitable</b>
<b>None n=50</b>								
Mean	2,042	1,203	0	839	88	522	399	1,110
SE+/-	38.7	84.3	0	97.4	45.0	22.8	17.7	91.6
Maximum	2,939	2,009	0	2,129	1,500	1,316	601	2,009
Minimum	1,500	40	0	0	0	449	40	40
<b>Old n=247</b>								
Mean	2,060	1,145	630	295	153	507	415	972
SE+/-	12.3	31.2	31.2	26.7	20	8.4	10	33.8
Maximum	2,969	2,266	2,191	1,789	1,914	1,249	1,243	2,266
Minimum	1,458	0	0	0	0	265	0	40
<b>New n=62</b>								
Mean	2,047	1,188	444	280	208	471	403	1,016
SE+/-	14.1	58.7	51.9	53.1	38.1	9.3	16.6	70.0
Maximum	2,569	2,300	1,400	1,351	1,096	988	939	2,149
Minimum	1,964	450	0	0	0	450	75	100
<b>Total n=359</b>								
Mean	2,055	1,149	538	368	154	503	411	1,016
SE+/-	10.3	26.8	26.0	26.5	16.6	6.8	7.9	28.7
Maximum	2,969	2,300	2,191	2,129	1,919	1,316	1,243	2,266
Minimum	1,458	0	0	0	0	265	0	40

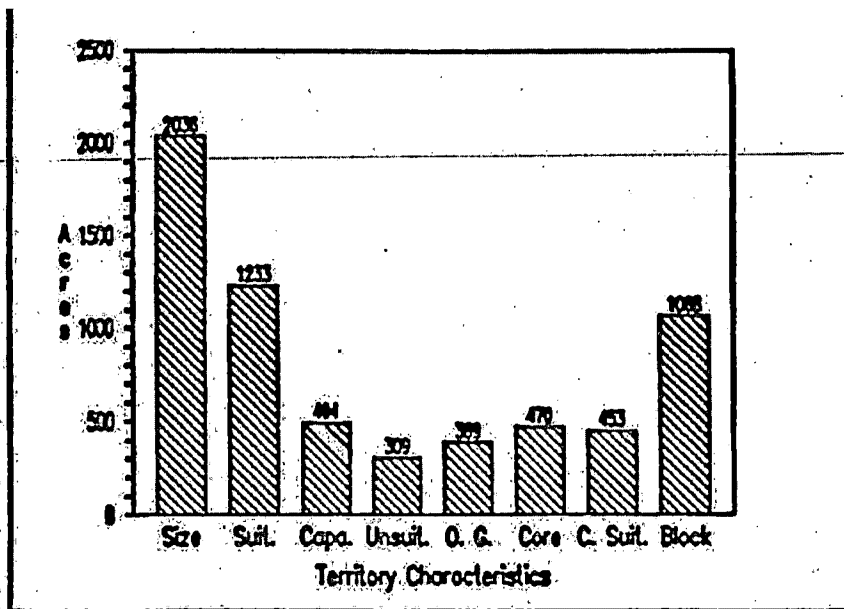


Figure 31. Mean characteristics of 48 Mexican spotted owl Management Territories on the Apache-Sitgreav National Forest.

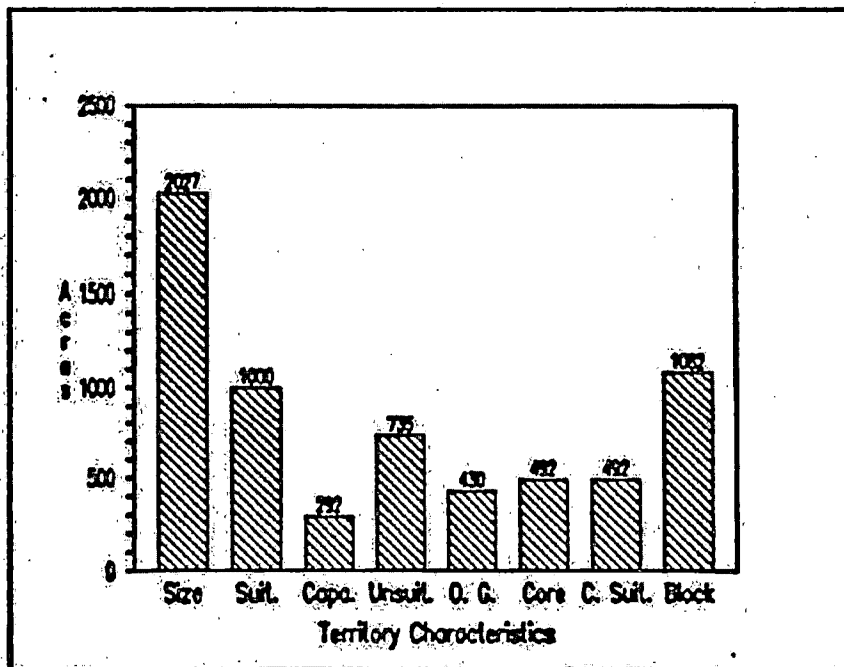


Figure 32. Mean characteristics of 2 Mexican spotted owl Management Territories on the Carson National Forest.

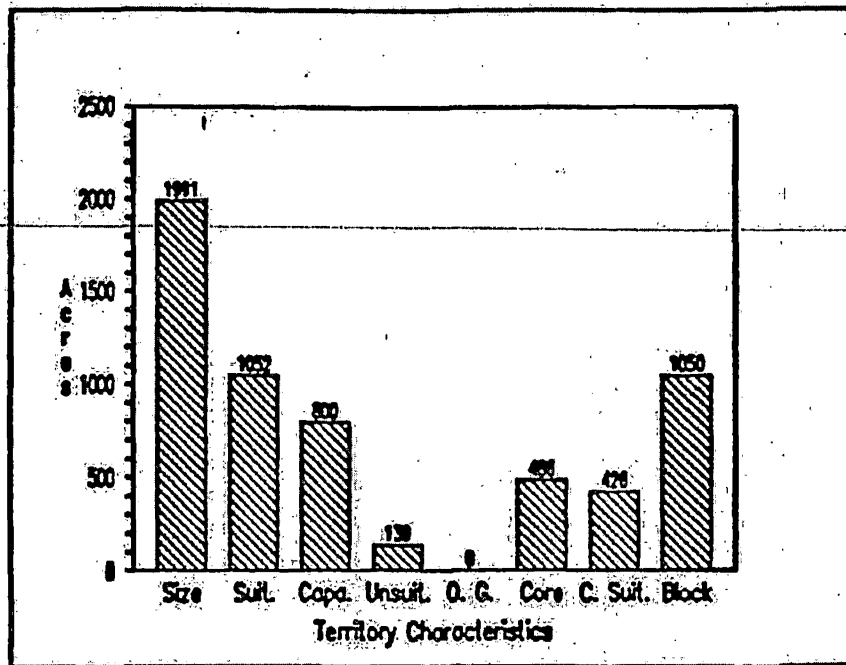


Figure 33. Mean characteristics of 12 Mexican spotted owl Management Territories on the Cibola National Forest.

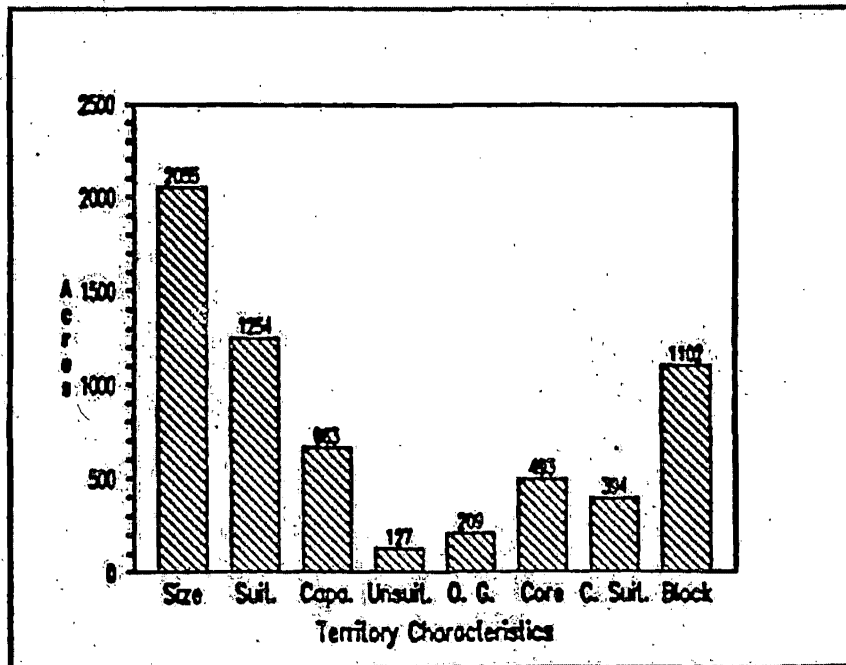


Figure 34. Mean characteristics of 69 Mexican spotted owl Management Territories on the Coconino National Forest.

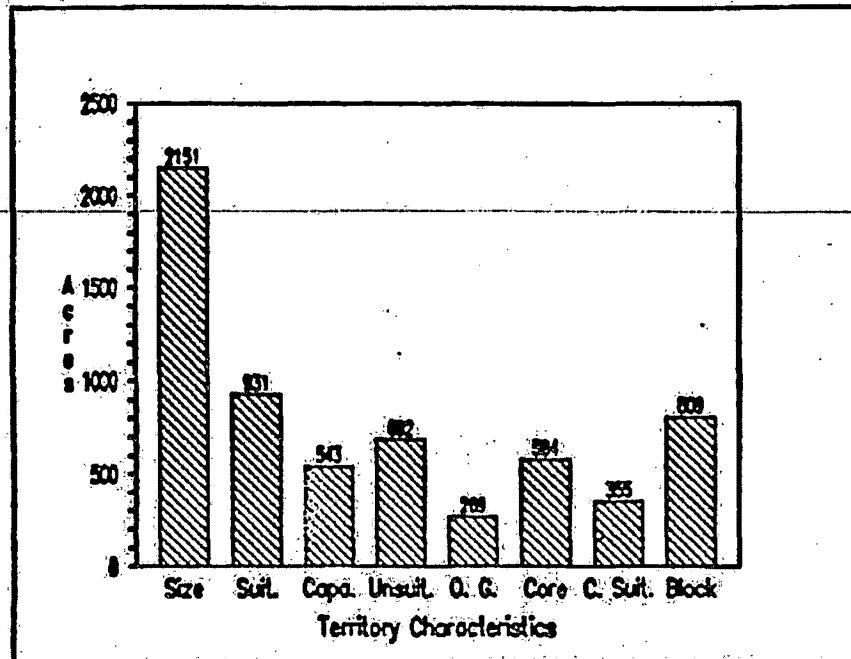


Figure 35. Mean characteristics of 71 Mexican spotted owl Management Territories on the Coronado National Forest.

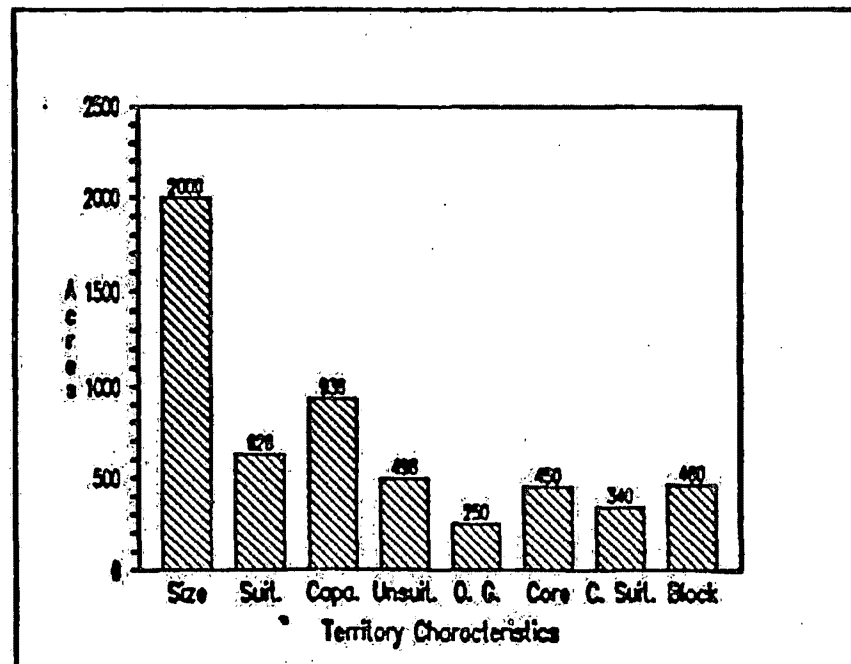


Figure 36. Mean characteristics of 22 Mexican spotted owl Management Territories on the Gila National Forest.



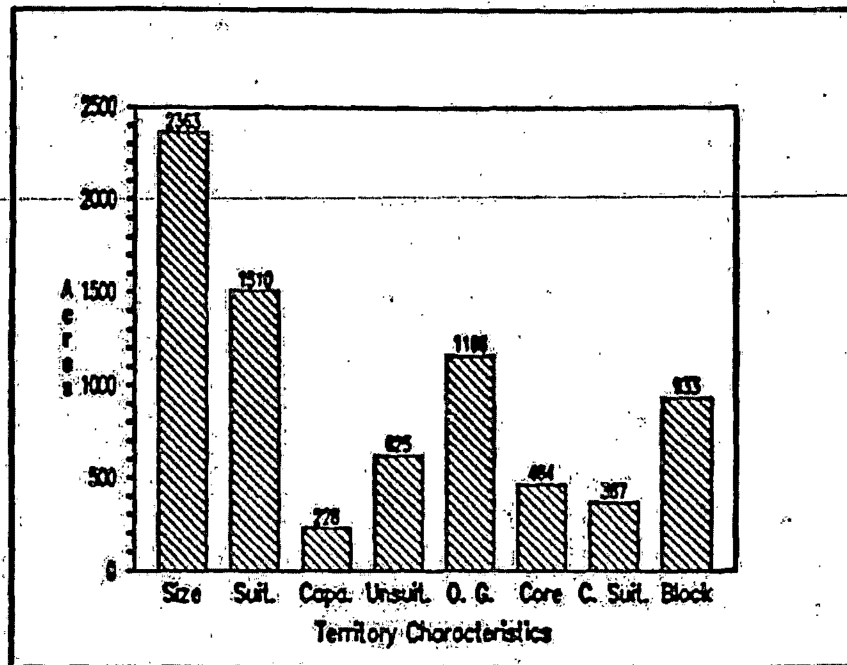


Figure 37. Mean characteristics of 3 Mexican spotted owl Management Territories on the Kaibab National Forest.

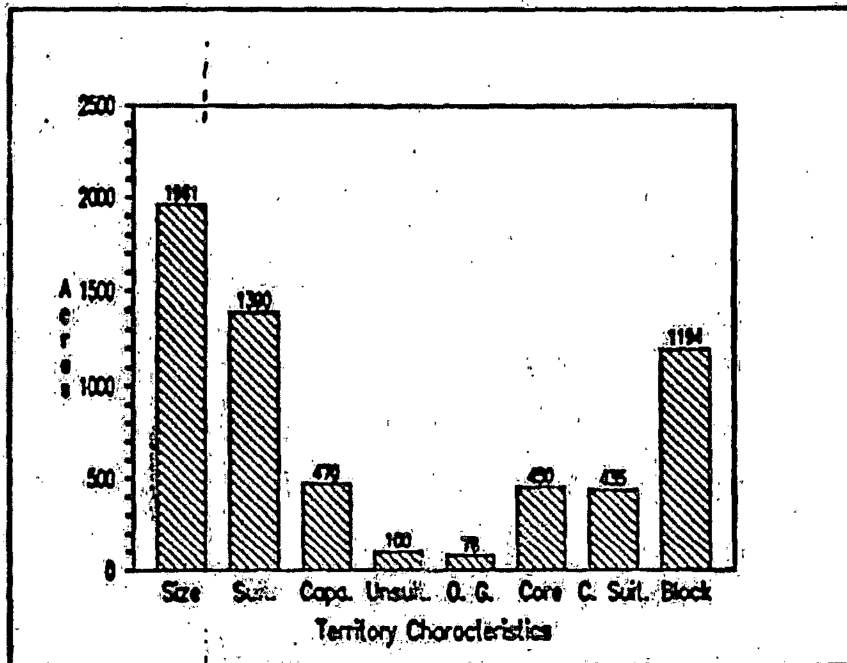


Figure 38. Mean characteristics of 94 Mexican spotted owl Management Territories on the Lincoln National Forest.

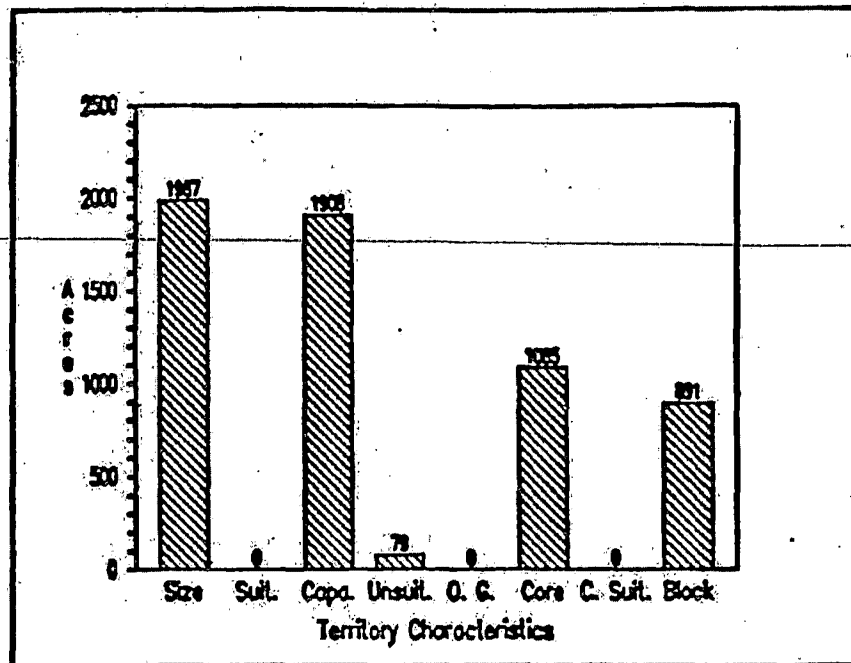


Figure 39. Mean characteristics of 4 Mexican spotted owl Management Territories on the Prescott National Forest.

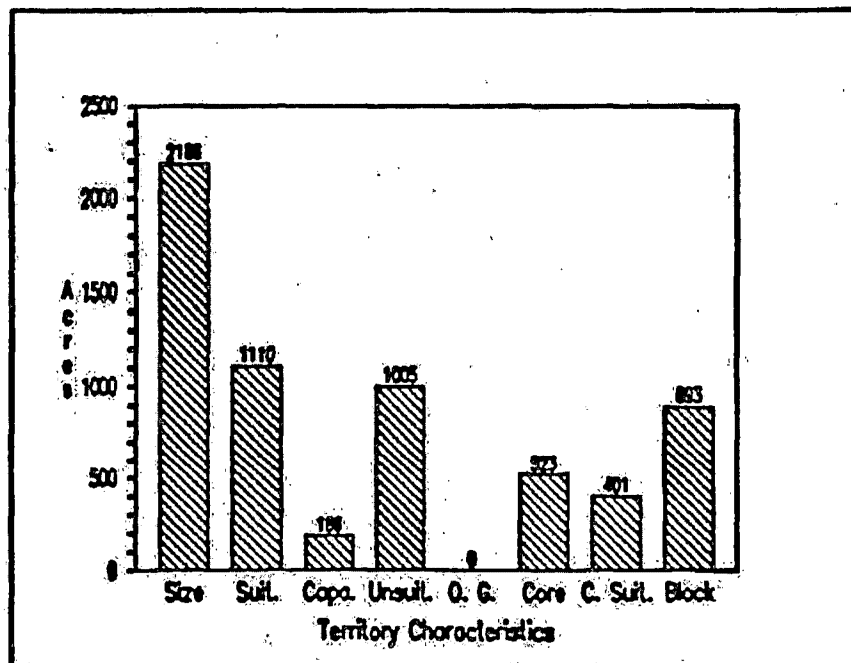


Figure 40. Mean characteristics of 34 Mexican spotted owl Management Territories on the Tonto National Forest.

### Region 3 Timber Sale Program

Between 1980 and 1990, the Region 3 Timber Sale program had an average annual sale quantity (ASQ) of 390 mmbf (Fig. 41), with just a little over 89 percent of the ASQ being offered for sale and about 80 percent actually being sold. In terms of acres, there were an average of 95,000 acres of timberland needed to provide the volume sold. Of this, 44 percent was in MSO habitat and 35 percent was reduced to a capable condition.

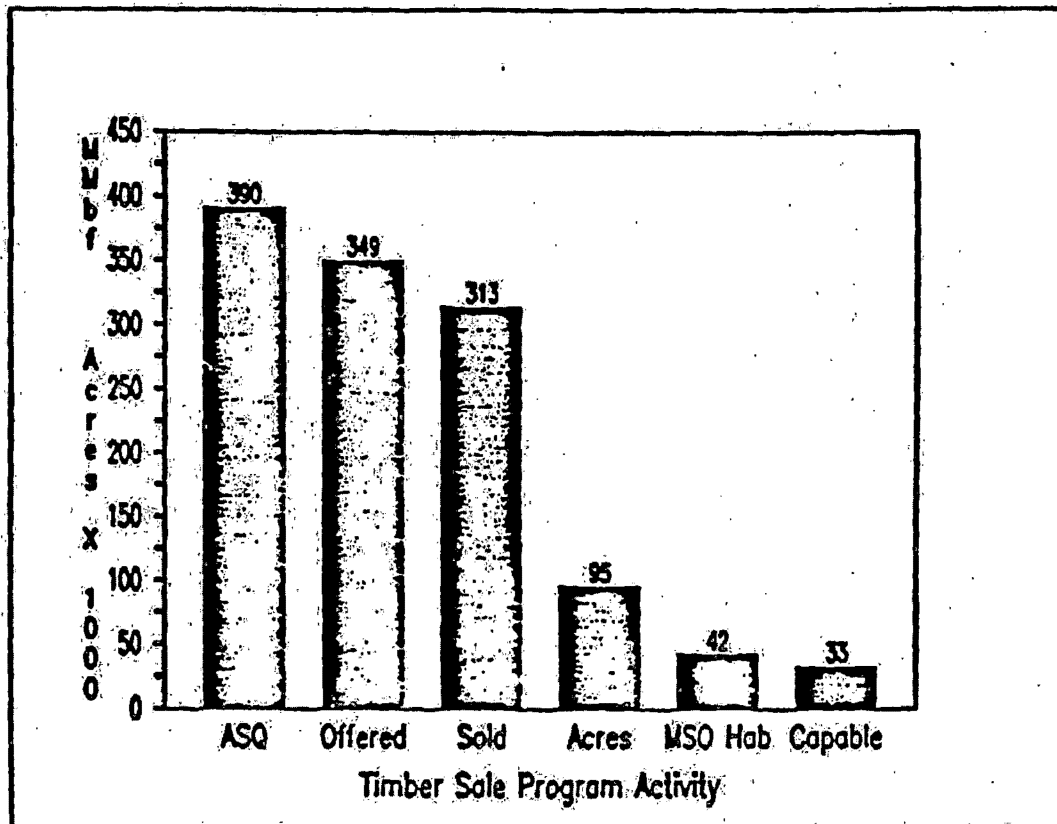


Figure 41. Mean aspects of the Region 3 Timber Sale Program between 1980 and 1990.

Figures 42 and 43 provide a graphic display of the sale program between 1980 and 1990, the first a curve and the second a regression of the curve. It is readily apparent that while the ASQ has been steadily climbing, the volume offered and sold, acres sold, acres sold in MSO habitat, and acres of MSO habitat sold made capable have been steadily declining. The trend for 1989 and 1990 reflect in part the management direction provided by ID Nos. 1 and 2, but also the reductions occurring as Forests are reviewing their Forest Plans. The Apache-Sitgreaves and Coconino have reduced their programs to 83 mmbf and 89 mmbf respectively.

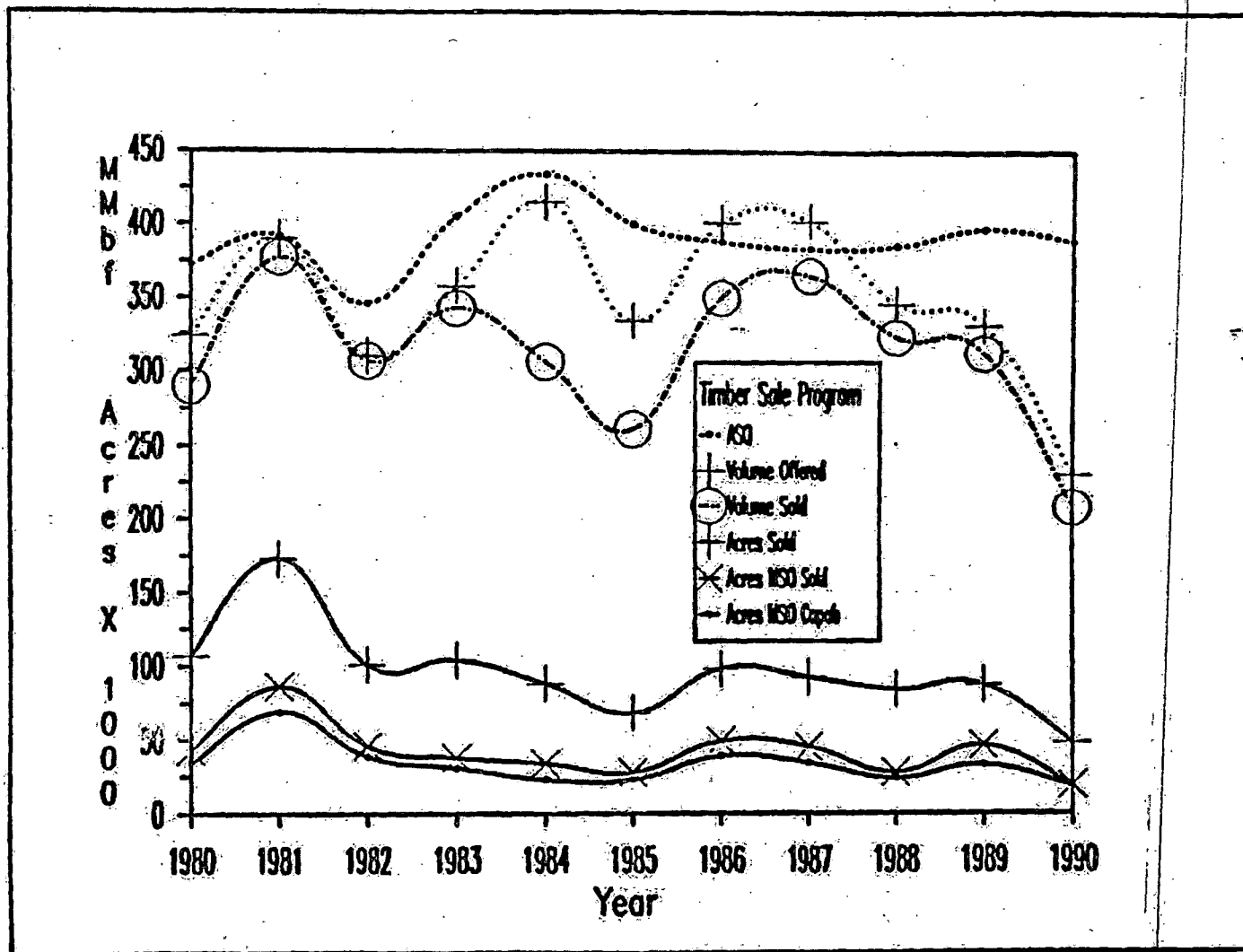


Figure 42. Yearly graph of the Region 3 Timber Sale Program between 1980 and 1990.

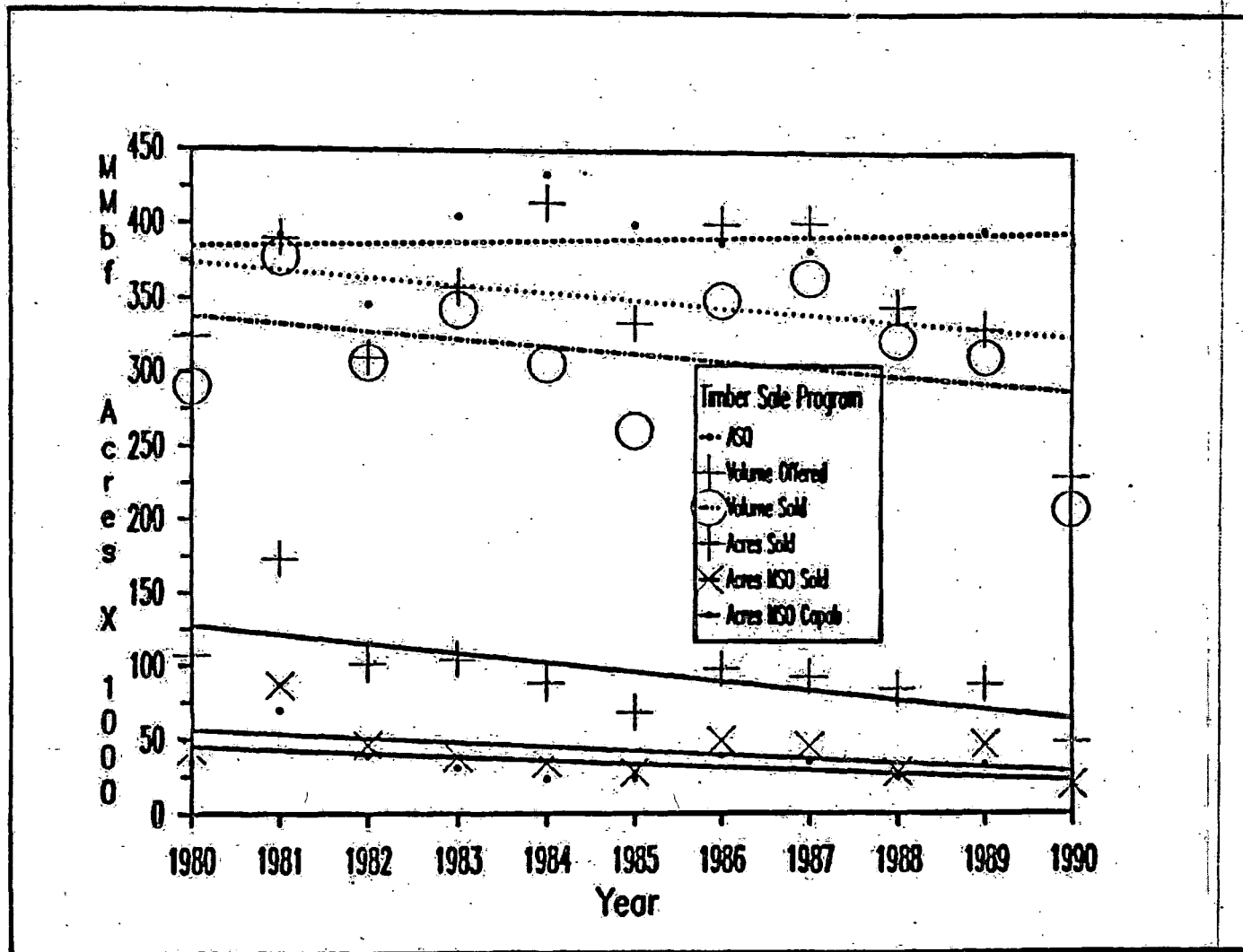


Figure 43. Regression of the yearly graph of the Region 3 Timber Sale Program between 1980 and 1990.

### Region 3 Timber Sale Program vs. Yearly Harvest

The amount of timber harvested each year on eight National Forests reporting harvest data were compared with the sale program for these same Forests between 1989 and 1990 (Table 2). Figures 44 and 45 provide a graphic display of the comparison of these sale and harvest values. Again, they show a steady decline as did the sale program. It is also obvious the harvest level is declining at a slower rate than the sale program. This is due to the harvest level being decided by market conditions and volume under contract. Currently volume under contract is declining, and thus the rate of harvest will more closely approximate the sale values in the future.

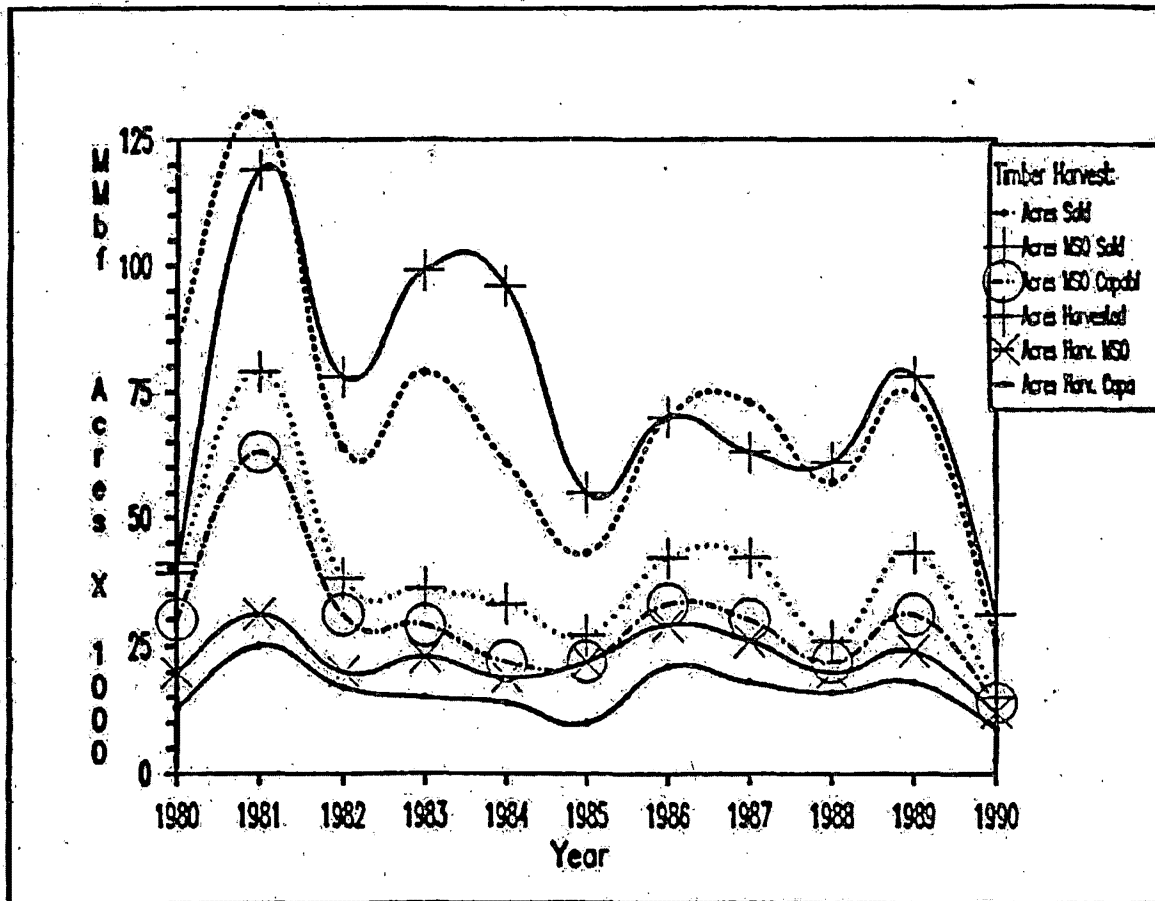


Figure 44. Graphic display of the Region 3 Timber Harvest levels between 1980 and 1990 on eight National Forests.

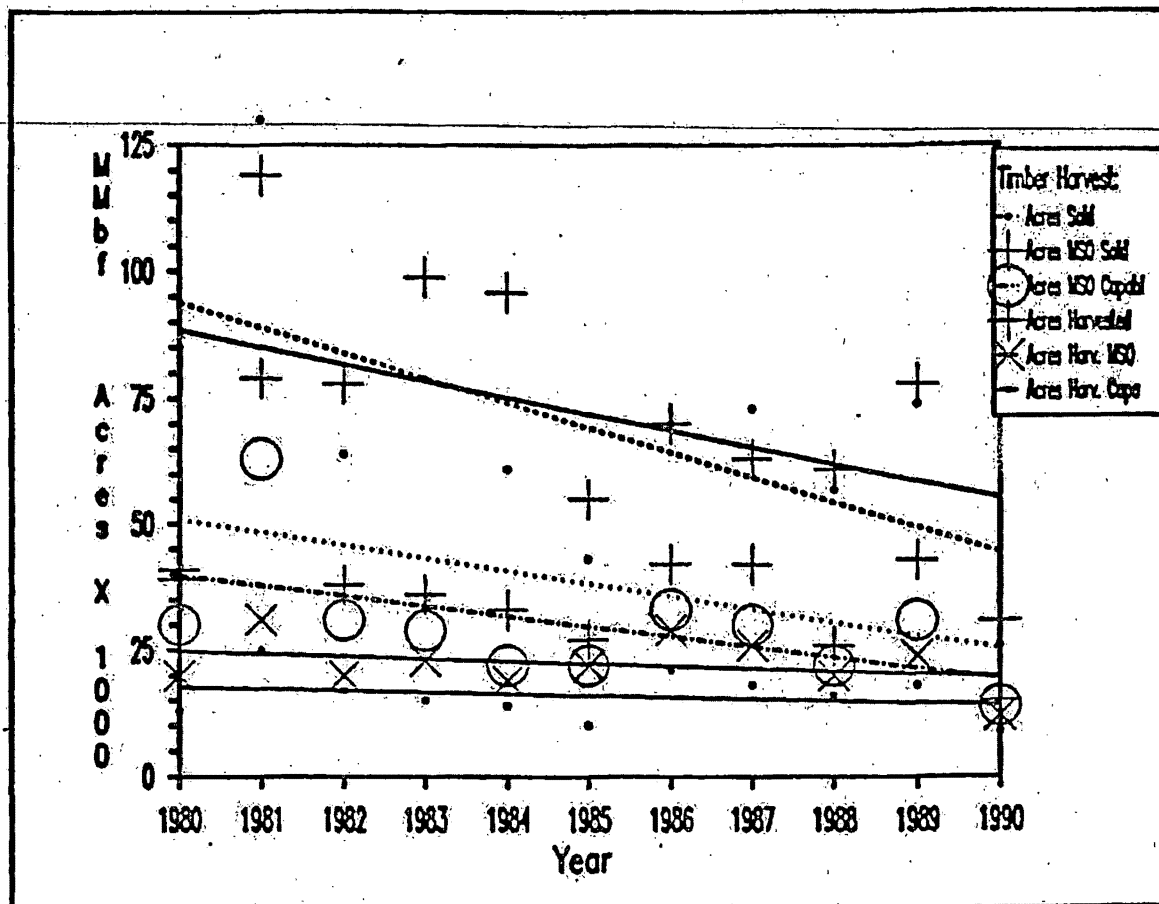


Figure 45. Regression analysis of the graphic display of the of the Region 3 Timber Harvest levels between 1980 and 1990 on eight National Forests.

**Table 2. Annual Sale Quantity (ASQ), volume offered, volume sold, acres to be harvested, acres of Mexican spotted owl (MSO) habitat to be harvested, acres of MSO habitat modified so it no longer met suitable MSO habitat conditions (capable) on eight National Forests between 1980 and 1990.**

	ASQ	Volume	Volume	Acres	Acres MSO	Acres MSO	Total Acres	Acres MSO	Acres MSO
Year	MMBf	Offered	Sold	Sold	Harvested	Made Capable	Harvested	Harvested	Made Capable
1980	254	220	216	85	39	30	41	20	13
1981	273	281	266	130	79	63	119	31	25
1982	227	207	198	64	38	31	78	20	17
1983	286	247	233	79	36	29	99	23	15
1984	316	310	221	61	33	22	96	19	14
1985	283	233	174	43	27	22	55	22	10
1986	269	284	233	70	42	33	70	29	21
1987	264	288	264	73	42	30	63	26	18
1988	267	259	230	57	26	22	61	20	16
1989	279	245	230	74	43	31	78	24	18
1990	280	127	111	26	15	14	31	12	9
AVG.	273	246	216	69	38	30	72	23	16



### Silvicultural Practices In Region 3

Between 1980 and 1990, Region 3 averaged just over 89,000 acres where some form of timber harvest occurred (Fig. 46). Sixty-six percent of the acres harvested were entered with harvest types that removed a portion of the volume, and generally left the stand in a stocked condition that was often multistoried. These harvest types include:

**Selection.** Selection of individual trees or small groups of trees. An uneven-aged management system.

**Salvage.** Harvest of fire, disease, or insect killed or damaged trees. Generally this type of harvest does not remove many trees from a stand, except when extensive fire, disease, or insect damage occurs.

**Commercial Thinning.** Reduce stocking levels and remove unhealthy or undesirable trees. The resulting stand is fully stocked, but canopy closure is more open to allow for growth. Resulting stands may be single or multistoried.

The remaining 34 percent were harvested with regeneration methods, including:

**Shelterwood/Seed Tree.** Regeneration harvest method where a new stand of trees is established using natural regeneration. Shelterwood leaves sufficient trees to provide a seed source and also provide site protection (shade for new trees, inhibit competing vegetation, and provide erosion control). Seed tree cuts leave only enough trees to provide a seed source.

**Removal.** Remove the overstory from an established, stocked understory. May be done as a final removal where all overstory trees are removed at one time, or as a partial removal where a series of entries remove the overstory.

**Clearcut.** Harvest of all trees in the stand. Generally includes site preparation and tree planting, but natural regeneration can be used.

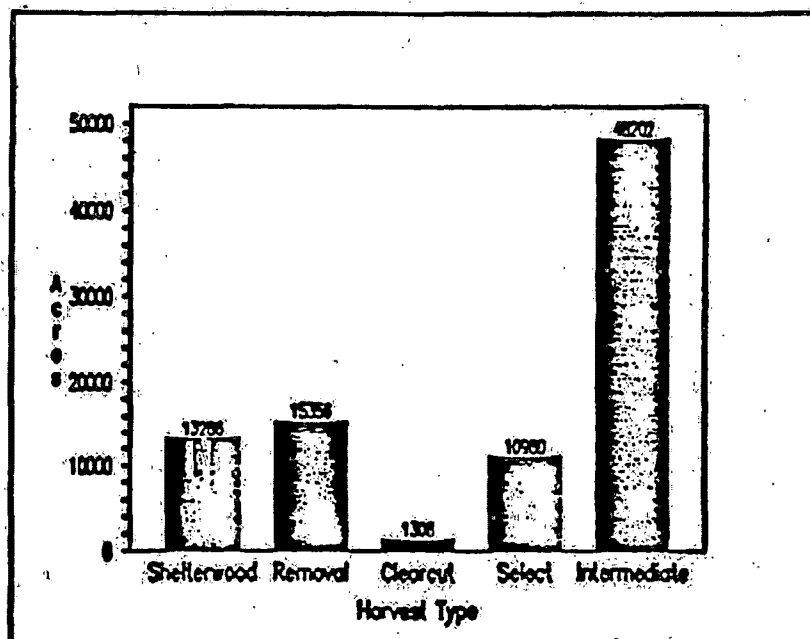


Figure 46. Silvicultural methods of the Region 3 Timber Sale Program between 1980 and 1990.

Figure 47 provides a graphic display of the yearly combination of harvest types used throughout the Region. The trends over the 11-year period are more obvious in Figure 48 where a linear regression was made of the curves in Figure 47. Here, it is obvious there is a general trend toward regeneration harvest types of silvicultural systems. The steep decline of the acreages in intermediate harvest that is not compensated for by large increases in other methods indicates there has been a steady decline in the total acres harvested over this time period. Clearcutting has generally remained steady, and has been used sparingly throughout the Region. There has been a gradual decline in use of the selection method, and a slightly greater increase in the use of shelterwood and removal methods.

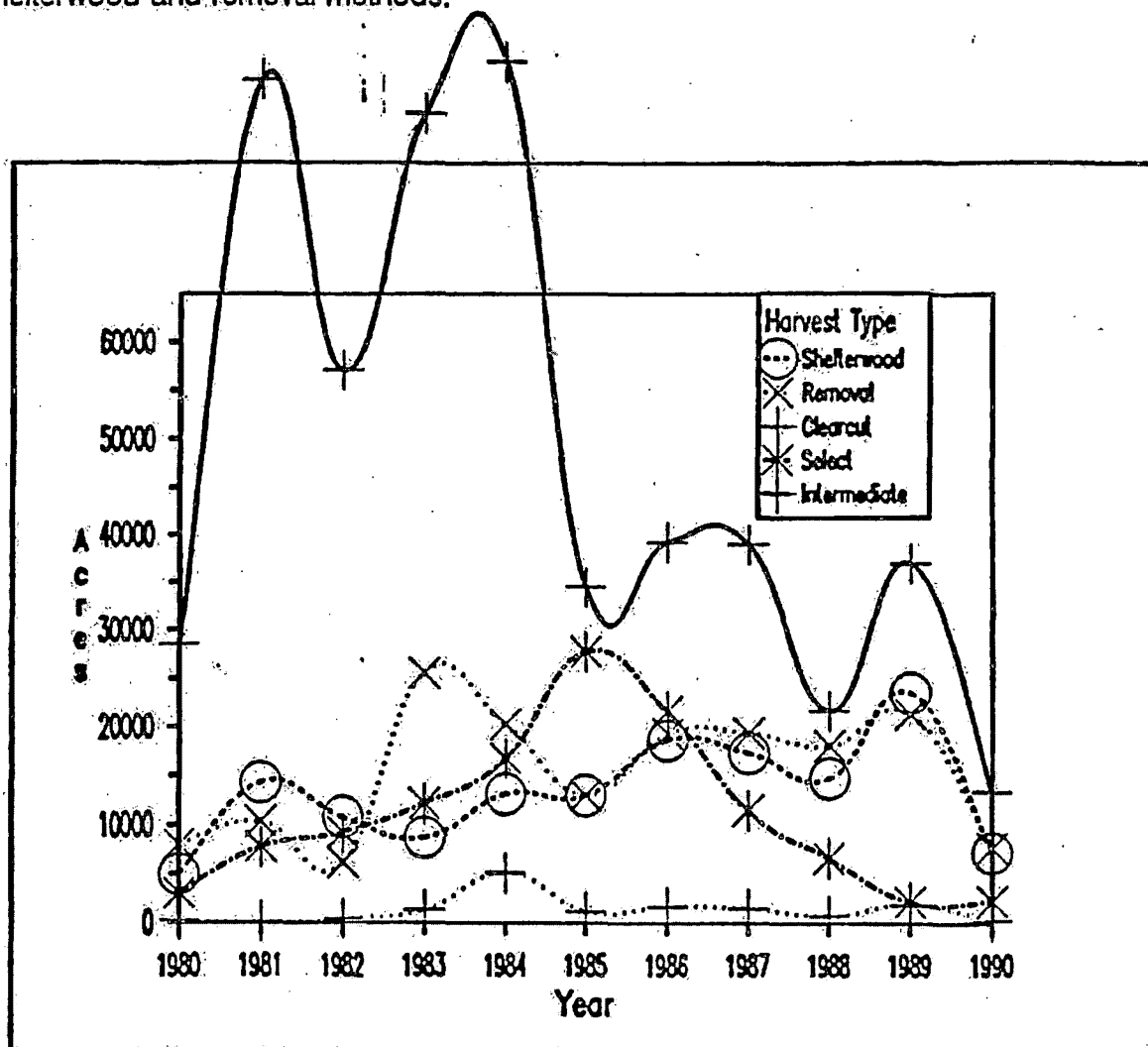


Figure 47. Graphic display of the silvicultural methods used in the Region 3 Timber Sale Program between 1980 and 1990.

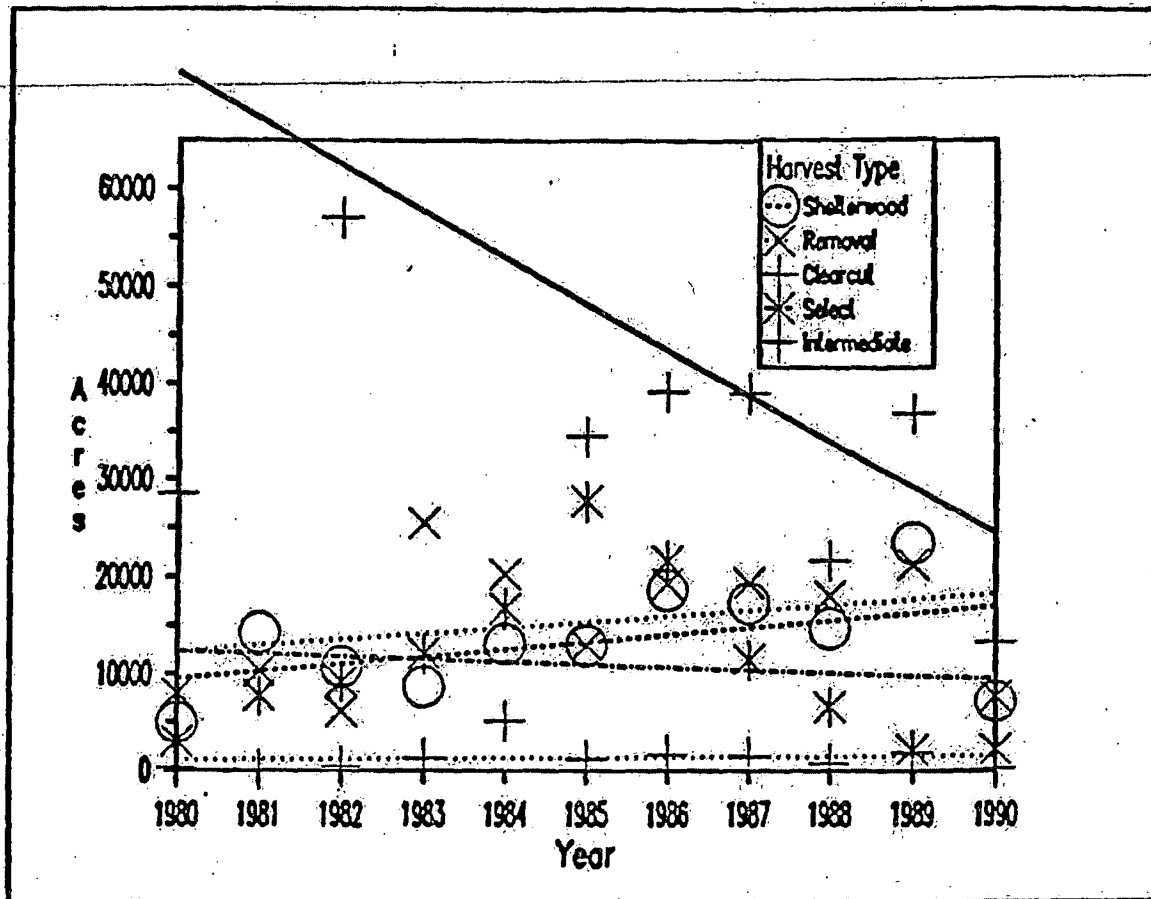


Figure 48. Regression analysis of the graphic display of the silvicultural methods used in the Region 3 Timber Sale Program between 1980 and 1990.

Figures 49 and 50 show the general trend in the volume harvested from each acre is increasing. In the early 1980's the Region was harvesting about 2.5 to 3.5 thousand board feet (mbf) per acre. This jumped to over 4.0 mbf in 1984 and 1985. Since this big jump, which reflects the change in silvicultural systems from intermediate and selective methods to regeneration methods, the volume per acre has leveled out and started to decrease.

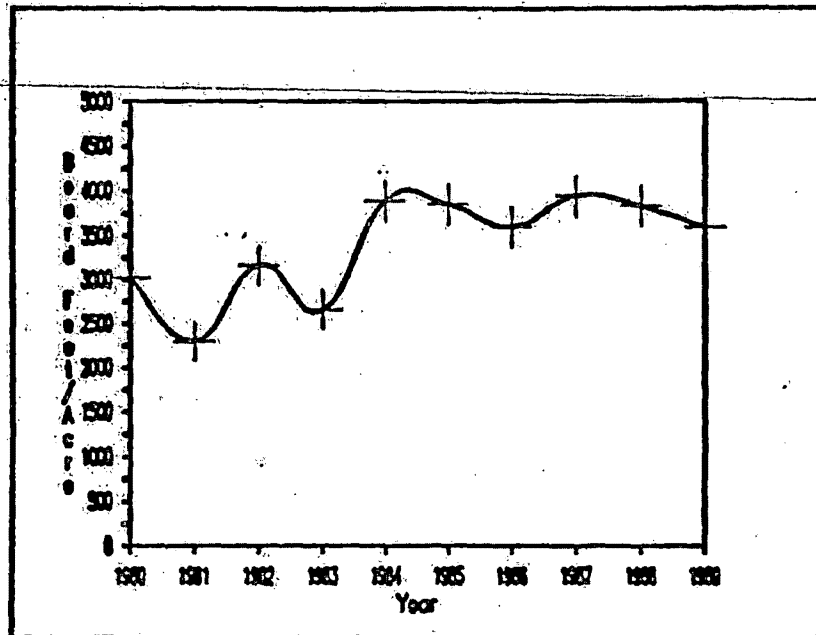


Figure 49. Graphic display of the volume of timber sold per acre for the Region 3 Timber Sale Program between 1980 and 1990.

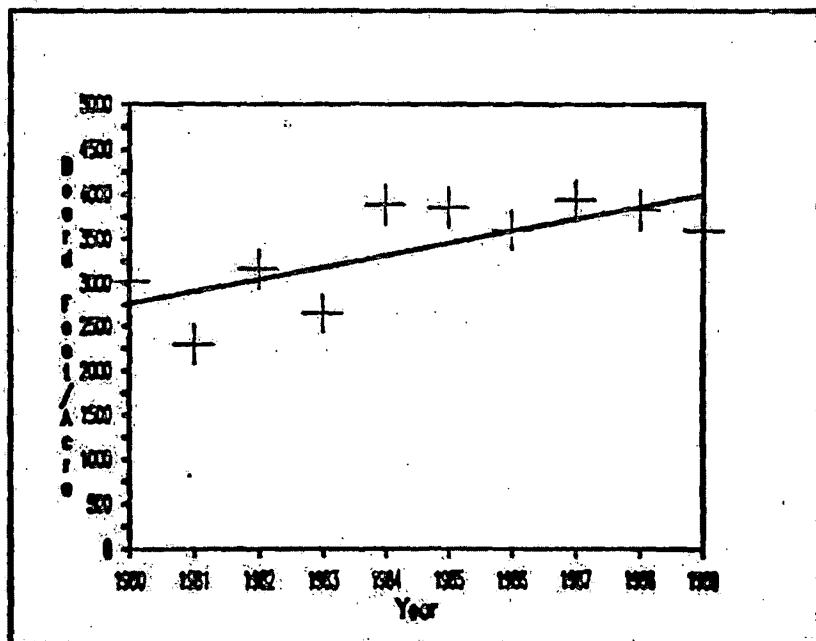


Figure 50. Regression analysis of the graphic display of the volume of timber sold per acre for the Region 3 Timber Sale Program between 1980 and 1990.

## Formal Monitoring

The Southwestern Region began monitoring Management Territories on the Coconino, Lincoln, and Santa Fe National Forests using a "formal" protocol (see ID No. 2) in 1989. Sixty-three sites were monitored to protocol. Thirty-five sites were monitored in 1990, with at least 15 of them being replicates of 1989 sites. It will not be known how many of the other 20 sites monitored on the Lincoln in 1990 were replicat sites until the 1989 Final Monitoring Report is completed by Skaggs. The changes on the Lincoln were a result of beginning density monitoring on a large block of land to start collecting population trend data.

In 1989, pair occupancy (75%) and reproduction (1.34 young/pair) were good throughout the Region (Table 3). The Santa Fe had the lowest reproduction with .67 young per pair and 60 percent pair occupancy. The Coconino had the highest with 100 percent pair occupancy and 1.8 young per pair, while the Lincoln was between the other two areas with 1.33 young per pair and 68 percent pair occupancy. In 1990, this was contrasted with lower levels of both occupancy (51%) and reproduction (.11 young per pair). The Coconino stayed at 100 percent occupancy, but dropped to .4 young per pair, while the Lincoln and Santa Fe reported no reproduction. It would not be unusual for reproduction to be lower in 1990 following a highly productive year as in 1989, but this was compounded by a third year of drought nearly Region-wide.

**Table 3. Results of Formal Monitoring of Management Territories on the Coconino, Lincoln and Santa Fe National Forests in 1989 and 1990.**

<b>Forest/ Year</b>	<b>Number of Sites Monitored</b>	<b>Number of Sites with at least a Single Present</b>	<b>Number of Sites with Pair Occupancy</b>	<b>Number of Sites with only a Single Present</b>	<b>Number of Unoccu- pled Sites</b>	<b>Number of Sites with Reproduction</b>	<b>Number of Young Produced</b>
<b>Santa Fe</b>							
1989	5	4	3.	1.	1	1.	2.
1990	5	2	1.	1.	3	0.	0.
Average	5	3	2.	1.	2	.5	1.
<b>Coconino</b>							
1989	5	5	5.	0.	0	5.	9.
1990	5	5	5.	0.	0	2.	2.
Average	5	5	5.	0.	0	3.5	5.5
<b>Lincoln</b>							
1989	53	48	39.	9.	5	28.	52.
1990	25	18	12.	6.	7	0.	0.
Average	39	33	25.5	7.5	6	14.	26.
<b>Region</b>							
1989	63	57	47.	10.	6	34.	63.
1990	35	25	18.	7.	10	2.	2.
Average	49	41	32.5	8.5	8	18.	32.5

## Informal Monitoring

Informal monitoring was begun in 1990 to provide nest and day roost information for Management Territories where no nest or roost sites were found during the previous or current years inventory. No formal protocol is required, though the formal monitoring protocol was often followed. In 1989, 97 sites on the Lincoln and in 1990, 81 sites on the Coconino and 101 on the Lincoln were informally monitored. Table 4 summarizes this data. The data collected at these sites represents from one informal visit to a number of visits, some following the formal protocol and some not following the protocol. Thus, these data are not comparable because there was not an equal search effort put into any of the Management Territories. They do represent minimum values for pairs and maximum values for unoccupied sites. The number of young indicates the reproduction identified on the Coconino and Lincoln for 1990 are close approximations of what occurred on those two Forests.

Table 4. The number of Mexican spotted owl Management Territories occupied by a pair (Pair Occupancy), a confirmed single, an unconfirmed single (Presence), or that had no owls present and the number of young produced for 182 informally monitored Management Territories in 1990.

Forest	Pair Occu- pancy	Confirmed Single	Presence	No Owls Present	Number of Young
Coconino	51	29	0	1	24
Lincoln 1990 1989	46 57	17 14	9 6	29 20	0 62+

## Site Occupancy

Site occupancy data were available for 3 consecutive years at 88 Management Territories. Though these data were not collected using a standardized, statistically valid monitoring protocol, they do represent minimum values for sites with pairs and maximum values for sites where no owls were found. Thus, they provide a valuable addition to support the occupancy and reproduction values determined from formal monitoring until sufficient monitoring data is collected. Table 5 provides a summary of the number of sites occupied by a pair, the number with a confirmed single, the number where only presence was detected, and the number where no owls were found.

Fifty-three (60%) of the 88 Territories had at least a single owl present all 3 years. Forty-five (51%) of the sites were occupied by a pair 2 of the 3 years and 26 (30%) had pair occupancy all 3 years. A total of 35 (40%) had no owls detected at least 1 of the 3 years. Of these, 12 (14%) were occupied by a pair 1 of the other 2 years, 11 (12%) had a single confirmed at the site and presence was detected at 12 (14%) of the Territories. No owls were found at 13 (15%) of the sites 2 of the 3 years. One of these had a pair the third year, while eight of them had only presence the third year.

Seven of the 88 Territories had site occupancy data for 4 consecutive years. Five of these Territories were occupied by a pair at least 1 of the 4 years, four had pair occupancy 2 of the 4 years, while two had pairs 3 of the 4 years and one had a pair at the site all 4 years.

Table 5. The number of Mexican spotted owl Management Territories occupied by a pair (Pair Occupancy), a confirmed single, an unconfirmed single (Presence), or that had no owls present during informal surveys of 88 Territories in 1988, 1989 and 1990.

Year	Pair Occupancy	Confirmed Single	Presence	No Owls Present
1988	41	21	26	0
1989	52	11	5	20
1989	41	12	9	28

767.



## MSO Population

Using the data that went into developing Figures 3, 6, 26, and 27, I developed Table 6 to estimate the number of Management Territories likely to occur on National Forest lands in Arizona and New Mexico. This was done by taking the amount of suitable habitat on each Forest that had been surveyed, determining the proportion of a MSO Management Territory per acre inventoried, and multiplying by the acreage of suitable habitat on the Forest. These were then summed for the Regional total. This method provided the most conservative estimate of the number of Management Territories on National Forest Lands. Other methods involved a proportionment based on the number of Management Territories for each type of suitable habitat surveyed on a Forest, and a proportionment based on Regional totals.

**Table 6. Acreage of suitable Mexican spotted owl habitat, amount surveyed, number of management territories established, and estimated total number of Management Territories for lands with and without timber harvest on each National Forest in the Southwestern Region.**

Forest	Acres Avail Harv OK	Acres Survey Harv OK	Known MT's Harv OK	Total MT's Harv OK	Acres Avail No Harv	Acres Survey No Harv	Known MT's No Harv	Total MT's No Harv	Acres Avail	Acres Sur- vey	Known MT's	Total MT's
A/S	300	123	52	127	70	22	18	57	370	145	70	184
Carson	200	91	0	5	50	15	2	7	250	106	2	12
Cibola	38	13	6	18	134	15	6	54	172	28	12	71
Coconino	240	195	46	57	116	69	59	99	356	263	105	156
Coron- ado	7	2	1	4	108	38	69	196	115	40	70	200
Gila	166	102	64	104	453	111	30	122	619	213	94	227
Kaibab	42	37	0	0	22	20	3	3	63	57	3	3
Lincoln	324	153	91	193	47	37	3	4	371	190	94	197
Prescott	65	20	5	16	68	0	0	13	133	20	5	29
Santa Fe	419	200	29	61	176	6	0	20	595	206	29	90
Tonto	186	65	24	69	135	23	9	53	321	88	33	122
Total	1,987	1,001	318	652	1,378	356	199	628	3,365	1,356	517	1,280

## MSO Population on Non-Federal Lands

Figure 51 provides an estimate of the number of MSO's on other than Federal lands in Arizona and New Mexico.

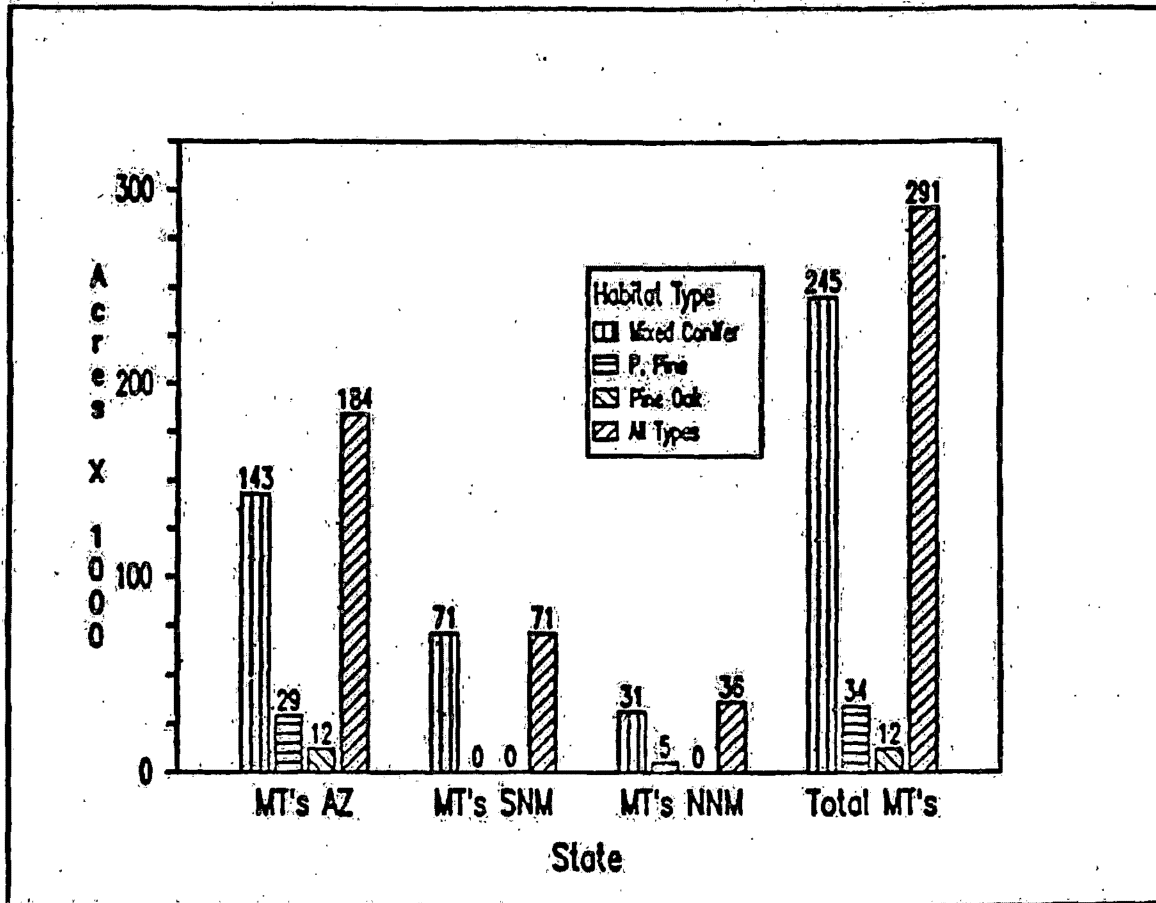


Figure 51. Estimate of the number of Mexican spotted owls on state, reservation, and private lands in Arizona and New Mexico.

## MSO Population In the Southwest

Estimates of the number of spotted owls in Colorado and Utah are not as straight forward as in Arizona and New Mexico. It has been estimated there may be 15 to 20 sites where MSO's may reside in Colorado. This likely represents about five pair. It is even more confusing in Utah. Here, National Forest lands may contain 5 to 10 pairs on 15 to 25 sites.

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Based on the Regional average of 66 percent of Management Territories having pairs, there are an estimated 1,037 pairs in Arizona and New Mexico for a total population of about 1,050 pairs.

## Comparison of Mexican and Northern Spotted Owls

### Habitat

The habitat of the northern spotted owl (*S. o. caurina*) (NSO) has been identified by most researchers on that sub-species as being comprised of mature and old-growth mixed-conifer and Douglas-fir habitat types. Historically these habitats were essentially contiguous from British Columbia, Canada to northern California. The only potential barrier to movement was the Columbia River. These mature and old-growth forests provide habitat for the northern flying squirrel (*Glaucomys sabrinus*), the major medium-sized rodent preyed upon by the NSO. Timber harvest began in the late 1800's within the range of the NSO, but it was not until the 1960's that significant fragmentation began throughout their range. Today it has been estimated that between 60 and 70 percent of their historic habitat has been modified so it no longer provides suitable habitat. Clearcutting has been the primary silvicultural method used. In addition, the intensity of harvest activities have left many large areas with little or no suitable habitat, and other areas with only small blocks of suitable habitat.

In contrast, MSO habitat is currently not contiguous, nor has it been historically. It can be described as "islands" of suitable habitat surrounded by large expanses of unsuitable habitat with often 30 or more miles between islands. Within the islands, habitat is not contiguous. Often, north slopes provide suitable MSO habitat, south slopes are unsuitable, and mesa tops are suitable, capable, or unsuitable. Drainage bottoms are usually suitable. MSO habitat on public lands has been reduced by about 25 percent. In addition, nearly two-thirds of the habitat made capable is comprised of ponderosa pine types, which have a much lower relative density (.12 MSO Management Territories per 1,000 acres of suitable habitat compared to .50 per 1,000 for mixed conifer and .72 per 1,000 for pine/oak), and have thus had much less of an impact on the owl population. Most areas still have large blocks of suitable habitat left and only small blocks of capable habitat, and most of the capable habitat still has some tree canopy left on it. The woodrat (*Neotoma spp.*) is the primary MSO prey species. This food source is not dependent on a mature or old-growth forest to survive and reproduce like the flying squirrel, thus at least some MSO foraging likely occurs in habitat that is much more open than currently identified suitable habitat.

### Management

NSO management guidelines have been based on a matrix of Spotted Owl Habitat Area's (SOHA) which vary in size from 1,000-acres of suitable habitat within a 1.5-mile radius circle to 3,000 acres within a 2.1-mile radius circle. No restrictions were placed on activities outside this acreage figure. These SOHA's were distributed in "clusters" of three at 1.5 to 3.5 miles between SOHA's measured on the outer edge of the circle. Clusters were spaced 8 to 12 miles apart, with at least two adjacent clusters fitting the spacing requirements. If there was not sufficient habitat to make a cluster, single SOHA's were spaced 7 to 10 miles apart. A grid of SOHA's was developed to cover the suitable habitat between blocks of "reserved" lands (not available for timber harvest). This grid was not developed around sites where owls were known to occur. Inventories were conducted at each SOHA to determine occupancy status. Boundaries could be moved somewhat to include a known pair or single if a lesser status was determined for the SOHA. A portion of these were monitored. The number of pairs of owls in reserved lands was not known, but was estimated based on suitable habitat.

Inventories for NSO may or may not have been conducted outside of SOHA's. No special management direction, other than that required by the Migratory Bird Treaty Act, was established for known owls outside of the network. Some Forests did apply various strategies to reduce the impacts on these owls.

In contrast, management direction is applied to all known MSO's. This direction is based on average habitat values found by Ganey (1988) (439 acre pair core area, 2089 acre pair territory, 998 acres suitable habitat per territory) and is assumed to provide sufficient habitat for a reproductive pair. Inventories designed to locate essentially all MSO's that respond to calls are required for 2 years prior to an activity occurring. Activities are allowed in a portion of these Management Territories based on Ganey's findings that a portion of the owls home ranges had had activities occur in them.

The strategy established by the "Scientific Committee" for the NSO is based on the premise that the network of SOHA's will not work, that a network of large blocks of habitat (Habitat Conservation Area--HCA) is necessary to provide for the population, that owls outside of these HCA's would receive little protection, and that the population will decline until the capable habitat in the HCA's becomes suitable.

The current strategy being used in Region 3 for the MSO is providing de facto HCA's which have a higher proportion of suitable habitat than those for the NSO because of the proximity of owls to each other. One difference between the NSO's HCA's and the de facto ones of the MSO is many of the ones for the MSO would never support the 25 or more pairs identified for the NSO HCA system because of the amount of the available, suitable, and capable habitat on the island. Where MSO's are not in close proximity, there are usually gaps in the suitable habitat, thus the Management Territory becomes similar to the strategy provided by the Scientific Committee where blocks of suitable habitat do not fit.

The current strategy being used by Region 3 is interim. As results of additional telemetry, other studies, and continued inventory and monitoring are available, modifications will be made based on the findings of these studies. The intent is to maintain a viable population of MSO's distributed throughout their range.